# THE FOUNDRY


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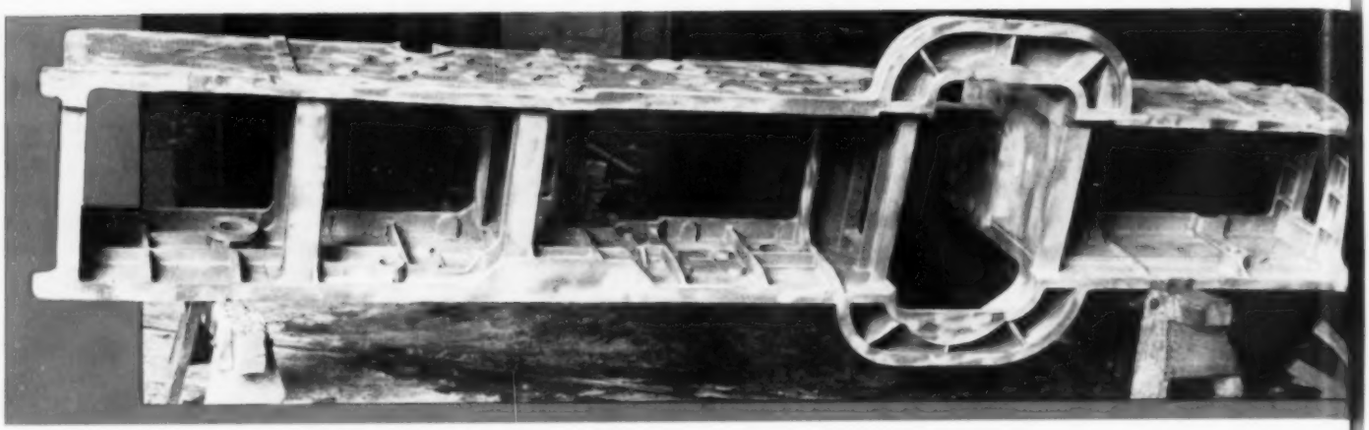
# "NO Core Failures



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EDITORIAL

## Industry Has Responsibility In Defense Program

WHEN Europe went to war last September, the American people were united in the determination that the United States should be kept free of that conflict. Ten months later that determination still is strong on the part of the great majority of citizens, but general opinion as to methods of accomplishing that result has undergone swift and striking changes. Germany's "total war" which resulted in the fall of Holland, then Belgium and now France, has shocked this country out of much of its complacency and has caused government people to move with great speed in a very real crisis.

Because of unprecedented dangers now confronting the entire Western Hemisphere, the democracy of the United States has embarked upon the greatest preparedness program in its history. The goal is "total defense," that is defense against any and all contingencies that may arise. Industry already is accelerating its tempo to meet the greater demands of the army and navy and plans are being transformed into orders at a surprising rate. The recently appointed National Defense commission, headed by Edward R. Stettinius Jr. and William S. Knudsen, is moving into the problem with all possible speed. Data now reaching the commission shows military needs, available manufacturing capacity and possible danger spots. Conferences with leaders in each industry will provide methods of eliminating the latter. The defense program, even as now contemplated, probably will require a minimum expenditure of from four to six billion dollars annually, and in the main will be accomplished through private industry.

What part will be assigned to the foundry industry in the consummation of this vast armament program? In all probability the magnitude of the responsibility which will fall the lot of casting manufacturers cannot even be estimated at this time, but a study of the first phases of the program should give an indication. According to reports from Washington, early needs will include engines and airplanes; machine tools; heavy guns; small arms; ammunition; trucks, tractors and tanks; as well as ships for the navy. In all but two of these classifications, castings are essential as engineering materials of construction, and in the two, castings will be needed to produce machines employed in the manufacturing processes. Because of the great progress made in all branches of the foundry industry during the past ten or 15 years, demands on the foundry industry probably will be increased as "bottlenecks" develop in the fabricating industries with which foundries can compete. Examples of this were cited in the articles by Col. Norman F. Ramsey on "The Foundry Industry and Army Ordnance" which appeared in the March and April issues of THE FOUNDRY.

From a military standpoint, it is more important to have available adequate modern plant capacity rather than the needed supply of the manufactured product, for capacity does not go out of date as rapidly as product. While a number of new foundries are being built to meet particularly heavy demands in certain fields, such as castings for machine tools and aircraft, the greatest need of the industry is in modernization of equipment rather than in new capacity. Whereever possible, management should undertake immediately to replace obsolete equipment and to mechanize operations, for this may not be possible in the near future. In all probability priorities control will be established if the armament program develops as is now indicated.

Although the machine tool industry now is faced with a serious shortage of skilled mechanics, a similar shortage has not as yet appeared in the foundry industry. Nevertheless in the not too distant future foundries must solve the problem of a lack of satisfactory manpower. The first pinch will develop in connection with supervisors of various types, and this will be followed by a shortage of molders and other skilled foundry workers. It is possible that young men still may receive sufficient training to be of tremendous help to foundries in this service to the nation, but prompt action is imperative.

Frank G. Steinebach
Editor

# Strike Up the

## WITH THE HELP

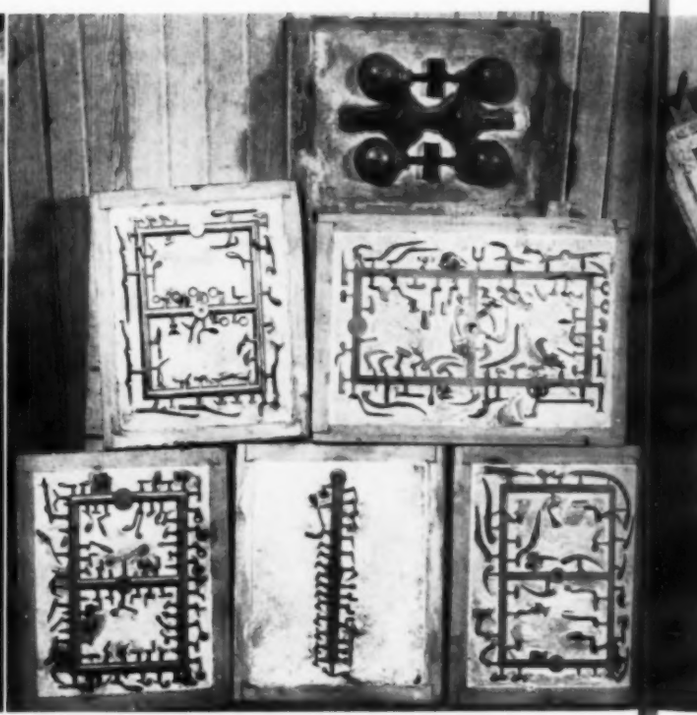


Fig. 1 (Left)—A light chain wrapped around a cleat on the shank and attached to a hook prevents the crucible from tilting. Fig. 2 (Right)—Typical gates of patterns mounted on plaster of paris follow boards

SOLEMN and ponderous authorities on ancient history may question the date. Split hair technicians may point out that a wind instrument and a musical wind instrument are not necessarily the same. The average man on the street who absorbs most of his information through the radio will argue stoutly that the first reference to wind instruments appears in the book of Joshua. A negro spiritual recently revived and popularized tells with many repetitions how "Joshua Fit the Battle of Jericho and the Wa-a-alls Came Tumbling Down!" The seven ram's horns blown lustily by the seven priests in the van guard of Joshua's army remind the present day reader of an automobile traffic jam, characterized more by nerve wrecking noise than by harmony.

Origin of the drum is shrouded in the mists of antiquity. The *Encyclopedia Americana,* reliable authority on every conceivable subject from *A* 1 to *Zero,* admits complete bafflement in setting a date for the invention of this instrument, or the name of the first individual who derived a sensuous pleasure from the noise produced by bringing the hand or a small implement in measured contact with a skin stretched across a wood frame. Popular tradition, in many instances as reliable an authority as any other, is inclined to award the distinction to Bacchus the rowdy, roistering, roaring, ribald, rollicking Cap Huff of mythology.

As with many other sections of the field of human endeavor the development of musical instruments has kept pace with the advance of

# Band

## P OF CASTINGS

By PAT DWYER

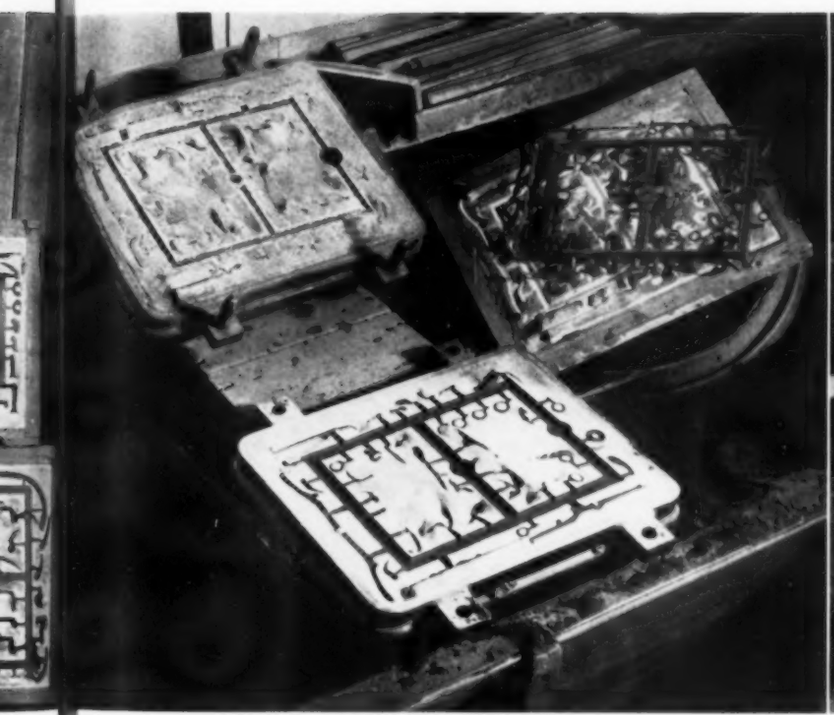
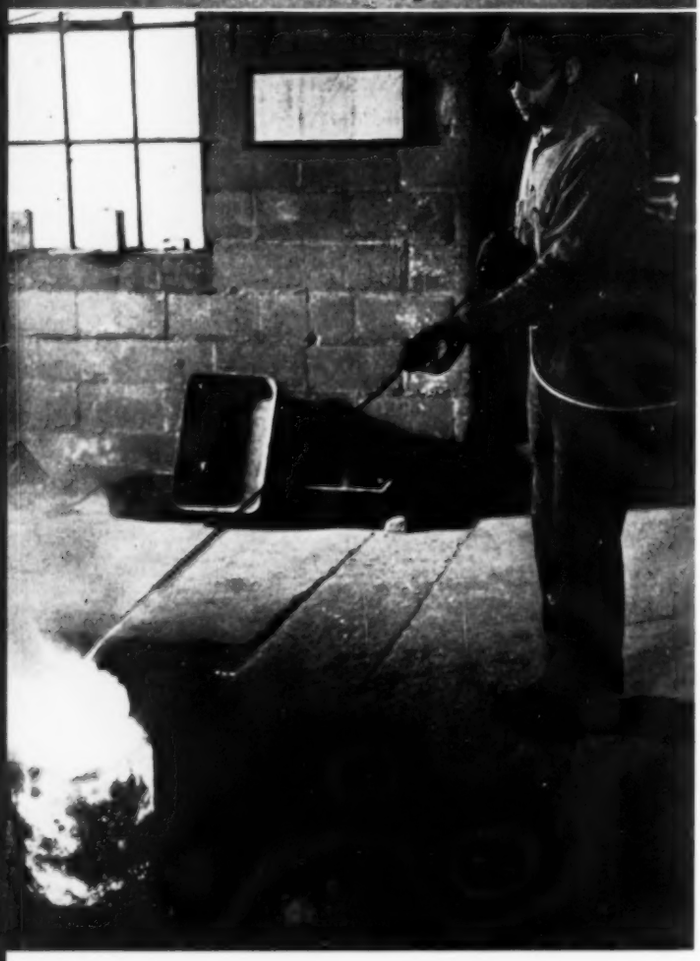


Fig. 3 (Left)—Molds are made in solid type flasks and stacked four high for pouring as shown in Fig. 1. Fig. 4 (Right)—Tiny castings are nipped one at a time from the gate and are collected in a sheet steel pan

civilization and the improvement in manufacturing facilities. Music has become an important feature with the people of every nation either in peace or war. We have army bands, commercial bands, civilian bands, high school and college bands. Orchestras infest every conceivable place where a dozen or more people congregate to eat or dance or both, from swanky night club to Joe's Place, full table de hote dinner for 2 bits.

Who makes all these instruments? Now we are on solid ground. No person knows and probably no person cares who made the first instruments, but every man or woman who blows a horn, beats time on a bass drum, or learned how to do the long roll on a snare drum, knows that C. G. Conn, Ltd., Elkhart, Ind., is the world's largest manufacturer of band and orchestra instruments. The company employs nearly 1000 skilled men and women housed in a group of modern factory buildings with a floor space of over 200,000 square feet, and turns out approximately 5000 complete instruments per month for domestic and foreign shipment. A score or more of the craftsmen in the Conn factory have been engaged in making band and orchestra instruments for over 50 years. In many instances sons work on the bench alongside the fathers.

Manufacturing band and orchestra instruments is an exceedingly complicated and intricate industry. With different models, different finishes, different bores, different bell sizes and the many accessories, the catalog lists over 10,000 individual items. It is claimed that the number of individual parts outnumber those made in the



largest automobile plants. Over 55,000 operations are listed. A saxophone has over 500 parts and there are eight members in the saxophone family. All parts, large and small are made in the Conn factory from the tiny set screw on the key mechanism of the flutes and piccolos and measuring only 0.056-inch in diameter to the great sousaphone bell.

Many of the small parts are cast in a well appointed foundry where all operations are under close laboratory control. Main features in this foundry are similar to those in all well conducted nonferrous foundries, but many of the operating details present interesting points of difference. Most of the castings as may be noted in several of the accompanying illustrations are so small that the greatest skill and ingenuity are required in laying the patterns out on a mold board in a manner to prevent miss runs. The patternmaker occasionally is handicaped to a slight extent in that he has to put all the small cast parts for an instrument on a single board. This is to facilitate the work in keeping a production record. Output of the foundry includes not only parts for the latest and most up to date models, but also parts for instruments in need of repair. The pattern storage vault adjoining the foundry contains patterns for instruments dating back almost to the beginning of the establishment by C. G. Conn in 1875. The boards are numbered and stored in racks lettered and numbered to provide ready identification.

### Melt Large Amount

The small size of the individual castings introduces on a magnified scale a problem common to all foundries and more particularly to nonferrous, steel and malleable iron foundries where the amount of metal melted is from 25 to 50 per cent greater than the weight of the castings. In this particular instance the normal yield of castings is 1 ton per month. The average amount of metal melted in a month is 10 tons. Return sprues and gates form the major part of the charges with sufficient new metal added to adjust the analysis and to compensate for the amount of castings shipped from day to day to the various finishing departments.

Castings are produced in sterling silver, aluminum, bronze and nickel. The sterling silver is a mixture of 92 per cent silver and 8 per cent copper. Aluminum is cast in two grades. One is the regular commercial No. 12 containing 92 per cent aluminum and 8 per cent copper. In the other, part of the copper is displaced by 3.5 per cent silicon. Bronze castings conform to one of three formulas. No. 1, the well known 85, three 5's, contains copper 85 per cent, tin 5 per cent, zinc 5 per cent and lead 5 per cent. No. 2 is approximately a bell metal with 70 per cent copper and 30 per cent tin.

The third bronze mixture is the standard 88-10-2, 88 per cent copper, 10 per cent tin and 2 per cent zinc, also known as gun metal or (*Please turn to page* 85)

Fig. 5 (Above)—Cleaning process is reduced to a few passes with a broom. Fig. 6 (Below)—A light jet of compressed air is driven through each pot of metal as it rests on the floor of the furnace room. Air is introduced to the bottom of the bath through a length of steel pipe bent at one end

# PREVENT HOT TEARS IN STEEL CASTINGS

BY WILLIAM J. PHILLIPS
Sales Engineer
Symington-Gould Corp.,
Rochester, N. Y.

FORMATION of cracks at elevated temperatures during casting contraction in the mold always has been one of the chief concerns of the steel founder. Importance of that phase of steel casting production is indicated by the amount of research that has been devoted to the problem. A great deal of attention always has been directed by the practical founder toward the solution of this difficulty, but science has stepped in only in recent years to establish a basis where a result once obtained could be duplicated with reasonable accuracy. Foremost among the investigators who have published results of their studies of hot tear formation are Briggs and Gezelius, Singer, Batty and Bull. Their work has supplied steel founders with information formerly lacking or very incomplete. Certain of the principles disclosed by their work also have given basis to practices adhered to by practical foundrymen as a result of observations in the production of intricate casting types. Investigations of Batty[1] and Bull[2] carried on with an eye to the effects of casting design on hot tear formations may be briefly summarized: (1) Basically good principles of design call of the nearest feasible approach to uniformity in cross section and liberally filleted member junctions. (2) Where uniformity in cross section is impossible, transition from heavy to light members should be accomplished by gradual blending. (3) Castings should be designed so that they may be fed by methods employing the principles of controlled solidification.

These are the chief factors governing design. Adherence to these principles will ensure production of ideal steel castings in so far as stress resistance is concerned.

However, it is common knowledge to the engineer and the foundryman that judged by these standards, the majority of castings could not be called well designed. It is equally common knowledge that these same castings not only have given satisfactory performance in the field but have been produced in the foundry free from hot tears. Obviously design features are not the only controlling factors in the production of sound steel castings. Work of Briggs and Gezelius has stressed the fact that there is a marked difference in the contractional properties of steels in the temperature range in which hot tears occur: (1) "Total amount of free contraction of cast carbon steel decreases as the carbon content of the steel increases. (2) At any temperature prior to the critical range the amount of hindered contraction is greater with decreasing carbon contents. The temperature at which hot tears are considered to occur is in the neighborhood of 1300 degrees Cent. (2372 degrees Fahr.). (3) Rate of contraction as well as the strength of the steel may influence formation of hot tears." Data obtained by Briggs and Gezelius on the contractional properties of cast carbon and al-

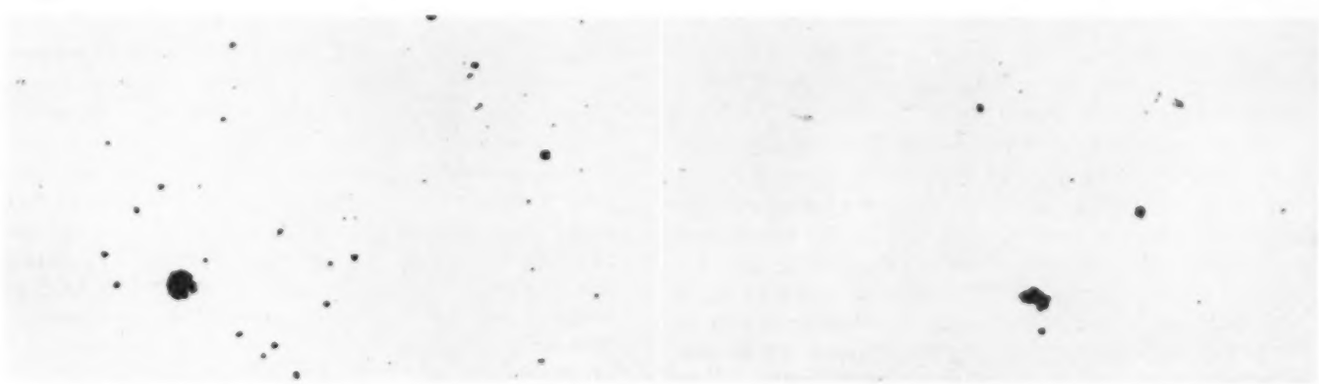


Fig. 1 (Circle above)—Type 2 inclusion associated with a tendency toward cracking. Fig. 2 (Left)—Type 1 inclusion appearing in steels free from cracking. Fig. 3 (Right)—Type 3 inclusion in steels free from cracking

loy steels are of immediate value to the steel founder. He may employ to great advantage the information disclosed in selecting a steel of the highest strength properties when pouring castings embodying poor features of design.

Research has established the fact that there is a decided difference in the contractional properties of steels of varying carbon and alloy content. The facts presented as a result of the contractional studies of steels have gone far toward explaining some of the apparent anomalies encountered in the production of steel castings and have indicated the necessity of maintaining chemical composition within well controlled limits.

Practical foundrymen have noted that similar castings poured from heats of identical chemical composition, made under the same furnacing methods, do not always show the same degree of freedom from hot tears. Further, where a large number of small castings are poured by hand pots from a bull ladle, it frequently happens that a certain number show hot tears while the majority are free from crack defects.

Suggested explanation of these observed phenomena is that changes in core and mold hardness or variations in pouring temperatures may account for these differences in casting quality. The opinion also has been advanced that steels made by different melting mediums vary widely in respect to cracking intensity.

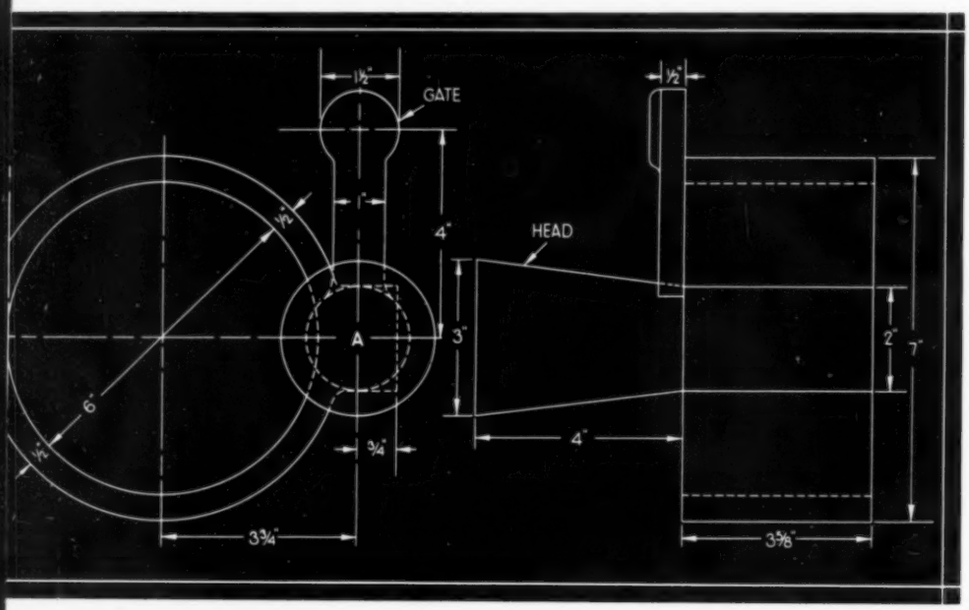



Fig. 4—Test pattern selected because of adverse design which created a hot-spot at point A

Pouring temperature has aroused considerable controversy. Generally accepted practice of American founders is to pour on the cold side in the belief that this practice is a definite help in eliminating the formation of hot tears. Karl Singer[1] as well as Briggs and Gezelius[2] favor hot pouring of castings prone to tearing. Apparent confliction of opinion as to the causes of varying degrees of cracking intensity seems to warrant investigation.

Steel used in conducting the following tests was made in an acid lined 1½-ton electric furnace. The charge was melted down under a black slag, boiled down to 0.06 to 0.08 per cent carbon, recarburized with low silicon pig iron and the boil continued until the desired temperature was reached at which time additions of ferromanganese and ferrosilicon were made to the furnace and stirred in. Final addition of aluminum in the proportion of 0.10 per cent was made to the furnace by ingot aluminum wired to a rod and plunged beneath the slag. Heats were tapped into a lip pour ladle which served either as a reservoir or as a direct pouring unit depending upon the type of casting to be poured. Chemical analyses of the heats studied were within the following range: Carbon 0.24—0.29 per cent; manganese 0.65—0.70 per cent; silicon 0.28—0.35 per cent; phosphorus 0.018—0.023 per cent, sulphur 0.032—0.040 per cent.

The first investigation studied the effect of varying core hardness upon the formation of hot tears. Cores were made from a New Jersey sharp silica sand bonded with a standard core oil and prepared in a small mill of the paddle type. No deviation from standard commercial practice was attempted in the mixing of the sand. Variations in core hardness were secured by controlling the amount of core oil in the mixtures. Baking temperatures were constant at 350 degrees Fahr. for all cores used in the test. The lowest and highest core hardness values were extremes never approached in the production of commercial castings. Hardness of the cores as determined on a Dietert core hardness tester ranged from a minimum of 30 to a maximum of 100.

A test pattern was developed as shown in Fig. 4, which embodied a distinctly adverse design in that a decided hot spot was created at the point *A*. This particular design was selected also because it allowed for the placing of a suitable feeder thus eliminating any possibility of error due to stress concentration at shrinkage cavities. The illustration shows the method of heading and gating employed in producing the experimental castings.

Six cored molds were prepared for pouring on each heat of similar chemical composition. The first set of molds contained cores with a core hardness number of 30. The next set of molds contained cores with progressively higher core hardness numbers until the maximum of 100 was reached; which was considered sufficiently far to cover any possible variations in commercial practice. During the course of the test no attempt was made to check pouring temperatures by pyrometrical observations. The only pouring temperature control consisted of pouring each set of castings by hand pot with the first metal from the bull ladle on each heat.

Examination of the cast- (*Please turn to page* 87)

# Youth's Opportunity IN THE FOUNDRY INDUSTRY

By N. K. B. PATCH

ON VIEW of the remarks made by retiring President Henry Washburn in his address to the American Foundrymen's association recently in Chicago, I feel it is pertinent to emphasize the opportunities for youth in the foundry industry. Many people are convinced that since the foundry industry is one of the oldest branches of industrial production, there is little or no opportunity for the development of new ideas, new inventions, new processes. Many people feel that the foundry industry is one where it is simply a question of repeating over and over again the same old thing which has characterized its past. The writer has been associated intimately with the foundry industry for about 40 years. During that time he has seen many remarkable advances in methods of castings' manufacture; materials resulting from the alloying of metals to improve the serviceability of the castings and an ever increasing knowledge of how to better apply castings to industry and at the same time how to better the working conditions of the men in the casting industry.

Forty years is a very short part of the time during which castings have been produced. Remarkable strides have been made in these 40 years, but to say that any further improvement is impossible would be a prophesy that is not based on sound judgment. The fact that we have made such rapid progress in the past assures a great future to those who bring to the foundry industry the true perspective, the right kind of optimism, the courage to attack a problem without fear or hesitancy, the ambition to find the solution to apparently unsolvable problems and the vision always associated with aggressive youth. Young foundrymen will find an increased opportunity for improv- (*Please turn to page* 90)

# ℞ ILLS & CURES IN THE NONFERROUS FOUNDRY

By ARTHUR FRITSCHLE
Federated Metals Division
American Smelting & Refining Co.
St. Louis

NO ATTEMPT has been made to list the various trouble producing factors in manner to suggest sequence of importance. It is impossible to say that sand condition is any more or any less important than melting practice, molding, gating, furnace manipulation and control, pouring temperature or any other of the many factors responsible for the production of defective nonferrous castings.

Molding sand is a rather complex subject involving a number of highly important inherent factors. Molding sand seems to be taken too much for granted. Far too little is known about the month to month changes in the basic elements, or the hour to hour working conditions of the sand. By condition is not merely meant the amount of moisture in the sand, or whether the sand has been sifted to break up lumps and remove nails, wires, scrap, shot and other foreign inclusions.

Many molders and foundry foremen seem to lack a definite understanding on why it should be necessary to differentiate in the selection of sand. They know of no definite reason why one grade of sand which produced satisfactory red bronze and brass castings should not be equally as good for yellow brass and manganese bronze. They do not see why one particular type, grade or kind of molding sand could be so definitely superior as to insure important all around advantages over other molding sands.

Among foundrymen an erroneous impression is prevalent that molding sand on the floor is a dirt heap, an expensive and necessary evil. Sand is just sand to be obtained under all conditions at the lowest possible price per barrel, ton or car load.

Clay content in molding sand quite generally is mentioned when sand condition enters the discussion on casting difficulties. Grain size, silica content, permeability, proper amount and right kind of bond, comparable refractory values, shape and texture of the silica particles in different kinds of molding sand, are ignored in many instances. Susceptibility of the silica particles to sintering and to breaking up into silica dust, which, unlike clay, does not bond when moistened, causes a build up of troublesome excess fines and definitely reduces permeability of the sand used from day to day. These factors rarely are discussed or given any particular thought in connection with casting defects.

Although the moisture content of the sand is an important factor at all times and often is connected directly with production losses due to defective castings, many foundries have no facilities for determining actual moisture content in the sand heaps. Moisture content should be established definitely and, if necessary, *corrected* not only at the beginning of the day's operation, but likewise after the molds are dumped and the sand turned over for subsequent operation. A moisture determining instrument costs very little compared to the important dividends it can be made

to pay in any ferrous or nonferrous foundry.

Practice of using molding sand permeated with steam and gas instead of aerating the sand to allow the gas to escape, is a trouble producing factor too frequently overlooked.

Permeability reduced by excess moisture content, or indirectly by steam and gas carried over in hot sand at the time the molds are rammed, often will produce casting defects showing the general appearance of cold shuts. The same defects may occur when the permeability is reduced due to (1) hard ramming, (2) to an excess of clay or silica dust, or (3) to a combination of excess clay and silica fines. Under these conditions the foundryman's usual reaction is to raise the pouring temperature of the metal and thereby simply aggravate rather than alleviate the annoying situation through the generation of more steam and more gas when the sand comes in contact with the hotter metal.

### Sand Is Important

Only a comparatively small number of foundrymen seem disposed to weigh carefully the facts and to consider the extent to which molding sand constantly is involved every hour of the day's operation. Probably more than any other single item in the brass foundry, molding sand is directly involved in the entire production, overhead and labor costs of every casting, good or bad. That this important tieup between molding sand and profit is not fully understood probably accounts for the fact that so many foundrymen hesitate to pay the price for high class dependable molding sand.

The same situation prevails in the selection of core sands. More time spent in selecting suitable and nationally recognized molding and core sands will pay satisfactory dividends even if they cost considerably more than the supposedly cheaper varieties available at some nearby creek or sand hill.

Pouring temperature is a highly important feature which is not always properly considered in relation to the square inch area or dimensions of the gates which lead from the runner strip or sprue into the castings proper. In many instances metal is poured within a good pouring temperature range, but the castings either are miss-run or exhibit defects similar to cold shuts. Usually when one of the gates is sawed off close to the casting the answer is obvious. The gates are pinched together or choked down to the extent that the metal is sprayed into the mold cavities. Under these conditions the streams of metal became prematurely chilled before they had time to flow around the cores, or to fill the mold properly and produce sound castings.

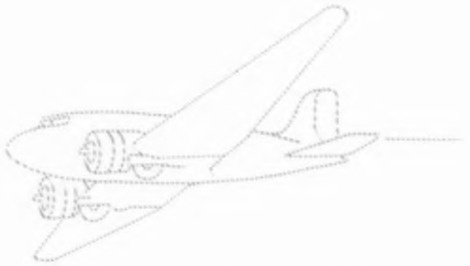
The temperature of the molten metal in the sprue and entrance to the gates may be entirely adequate to insure completely liquid metal in the castings but because of faulty molding practice or gate design the metal becomes chilled to an extent that prevents it filling the mold. The usual reaction is to pour subsequent heats at a higher temperature, but in the majority of instances that brings on more trouble from several other directions. It is simply a case of barking up the wrong tree.

While investigating shrinkage troubles, particularly in connection with pressure tight castings, many foundrymen claim that they tried risers to overcome the difficulty, but had more trouble than before. Careful investigation usually showed that the trouble was caused by a wrong application of the riser theory. The operator did not seem to have any conception of the basic principles involved, or the practical application to insure satisfactory results, usually within easy reach.

Universal experience shows that where risers do not function properly, or where they actually cause or contribute to (*Please turn to page* 92)

This article is from a discussion before the Regional Conference staged by the St. Louis District Chapter of the A.F.A. last October.

# *Metallurgical Aspects of*



# BRAKE DRUMS

## *for Heavy*

By V. A. CROSBY and G. A. TIMMONS
Climax Molybdenum Co., Detroit

CONSTANTLY increasing dependency on bus and truck transportation has necessitated developing materials capable of satisfying rigorous requirements of brake drums for heavy duty service. With the advent of higher speed railroad service, the problem of adequate braking facilities is demanding the attention of railroad engineers. Larger airplanes, required to land in comparatively small areas, likewise place increasing demands on brake drum performance. Design of brake drum units rests with the mechanical engineer, but the problem of developing materials satisfactory for these applications must be solved by the metallurgical engineer and the foundryman.

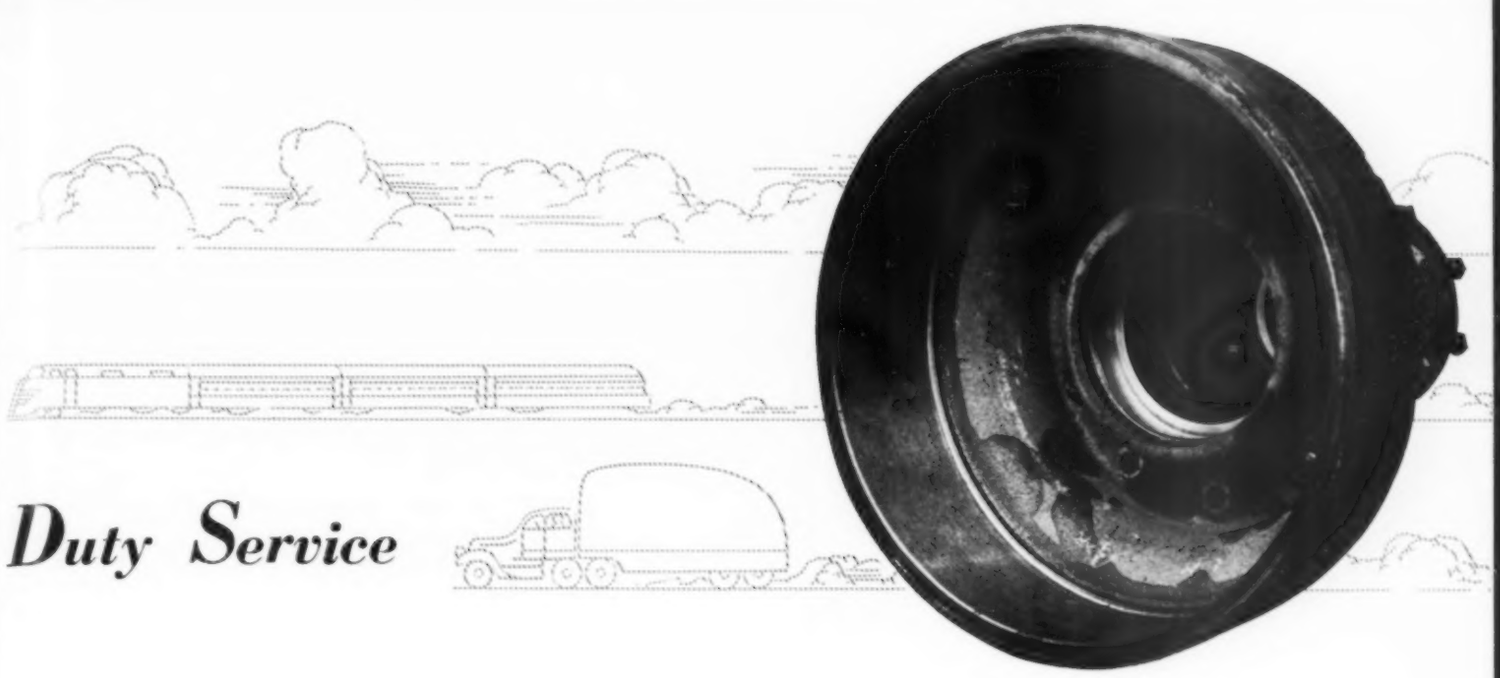
Tonnage of cast iron represented by brake drums gives a perspective of the size and importance of this problem. For 1939, it has been estimated that new trucks and buses, of two tons capacity and over, consumed 26,000 tons of iron for brake drums alone. Probably another 10,000 tons could be included for trailers, plus truck and bus replacements. A reasonable estimate for airplanes and railroad applications would be 4000 to 5000 tons. Therefore, the total would approximate 40,000 to 45,000 tons of cast iron. A large percentage of this tonnage is alloyed to develop properties necessary to increase the service life of these units and to insure the safety of occupants, pay-load and equipment.

Where fast-moving, heavy loads must be stopped quickly or where brakes must be applied continuously during descent of long grades, temperature effects become increasingly important. As the drum temperature increases, tensile strength, elastic modulus, and wear resistance are reduced, and the problem of thermal checking becomes critical. Engineers long have recognized these facts and much effort has been expended in designing drums to permit rapid dissipation of heat.

Apparently a material suitable for brake drums for heavy duty service involves a series of requirements difficult to satisfy with any one composition. Therefore, the ideal material must be a compromise embodying an optimum balance of the main requirements, namely, resistance to wear, high coefficient of friction, good strength, resistance to thermal checking and resistance to scoring.

The following facts are most evident in service reports and data obtained from develop-

Fig. 1 (Left)—Thermal checked braking surface of large truck brake drum. Fig. 2 (Right above)—One type of heavy duty brake drum with cast steel shell lined with cast iron



# Duty Service

ment or experimental projects on brake drums: 1—Cast iron apparently produces the best combination of relatively high coefficient of friction and resistance to wear and scoring; 2—most drums removed from heavy duty service fail by heat checking; 3—many drums are removed due to excessive wear; 4—some failures have been due to insufficient strength, either at atmospheric temperature or at elevated temperatures to which the drums are sometimes heated in service; 5—while most removals result from excessive heat checking, records have indicated drums made of cast iron with high carbon contents, (3.50-3.80 per cent), are more resistant to heat checking than drums made of cast iron with lower carbon contents.

Table I

**Using Higher Carbon Irons**

| Iron | T.C. Per Cent | C.C. Per Cent | No. of stops |
|---|---|---|---|
| A | 3.36 | 0.50 | 21 |
| B | 3.49 | 0.65 | 18 |
| C | 3.50 | 0.60 | 23 |
| D | 3.76 | 0.64 | 26 |

Table II

**Tests of Alloy Iron Drums**

| Iron | T.C. Per Cent | Mo Per Cent | No. of stops No checking |
|---|---|---|---|
| E | 3.55 | 0.79 | after 50 stops |
| F | 3.63 | 0.49 | 35 |

Unfortunately most data pertinent to the brake drum problem have been obtained from service-life records. While tests in service offer actual, quantitative life data under operating conditions, brake drum failures usually result from a number of causes, and it generally is impossible to separate the variables and evaluate the importance of each. The metallurgist or foundryman who wishes to form a basis for the solution of the problem in terms of past experience finds himself fairly well confined to the data obtained from service records and fundamental considerations.

The following requisites must be considered before attempting to recommend or produce a suitable material for heavy duty brake drum service. 1—Relatively high coefficient of friction; 2—ability to resist scoring; 3—good wear resistance; 4—high strength at atmospheric and elevated temperatures; 5—high modulus of elasticity (rigidity); 6—resistance to thermal checking; 7—ability to maintain its original characteristics; after hours of service; 8—resistance to plastic deformation (permanent set).

### Tendency To Score in Service

While soft, low carbon steels possess a high coefficient of friction in contact with brake shoe material, they have a strong tendency to score in service which soon renders them useless unless they are removed and resurfaced. Drums of higher carbon content have less tendency to score but become *glazed* in service, because of the formation of martensite on the braking surface after several applications of the brake shoes. Due to frictional resistance surface temperature is raised above the critical temperature of steel. When pressure of the brake shoe is released, the surface is subjected to a drastic metallic quench produced by the cooler body of the drum. Hard martensitic surface thus produced polishes readily, and the coefficient of friction between drum and lining is

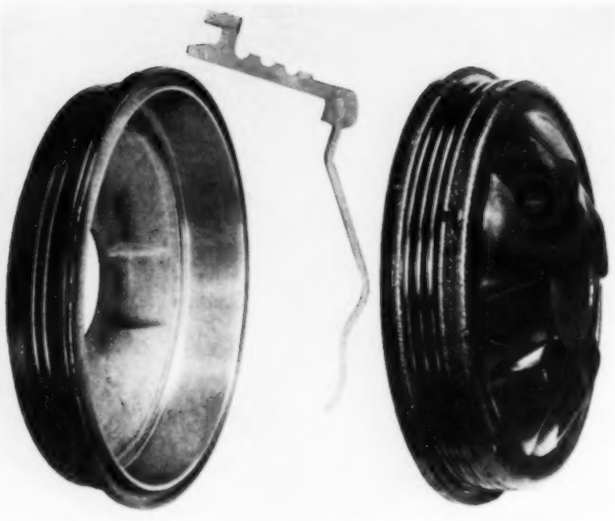


Fig. 3—Another type of brake drum employing pressed steel web and cast iron rim

reduced materially. Due to the continuity of a steel surface, thin layers of this hard, brittle material will persist even under severe stress conditions.

Although the same material forms on the inside, or wearing surface, of cast iron drums, the discontinuity of the surface, because of graphite flakes, prevents persistence of the martensitic layer. This surface layer is brittle in nature and the high stress concentrations produced in the vicinity of each graphite flake during brake shoe application aid in removing it almost as rapidly as it is formed.

For these reasons gray cast iron offers the best possibility of satisfying the basic requirements for brake drum materials. It possesses a high coefficient of friction, good wear resistance and because of its structural characteristics, it has the ability to resist scoring. The problem before the metallurgist is to increase the tensile strength of a cast iron and reduce or eliminate its tendency to heat check.

The problem of securing sufficient tensile strength is important from the viewpoint of both safety and weight reduction. In service the drums must withstand high pressures exerted by power-applied brake shoes, pressures which readily may produce stresses within the drums as high as 30,000 to 40,000 pounds per square inch. Drums often may be forced to withstand these stresses even at considerably elevated temperatures. Therefore, the material must possess as high an elevated temperature tensile strength as is possible without sacrificing other important factors. Most data indicate that the irons which exhibit higher strengths at elevated temperatures also possess higher strengths at atmospheric temperatures. Therefore, the iron should possess high room temperature tensile properties.

*Thermal checking, heat checking crazing,* etc., are terms applied to the series of fine hair cracks, arranged more or less in a network pattern and appearing on a metallic surface which has been subjected to rapid heating by frictional resistance, as shown in Fig. 1. Actual method of formation is not known definitely but explanations have been offered.

### Produce Temperature Differentials

One explanation indicates that during application of brakes, temperature of the braking surface of a drum becomes sufficiently high to melt a surface layer of cast iron. Beneath this surface layer, the metal is raised to temperatures that vary inversely with the distance from the braking surface of the drum. The temperature differentials thus produced result in high stresses being set up within the drum, due to accompanying volume changes. These volume changes may be divided into two classes: 1—changes resulting from simple thermal expansion and 2—those resulting from the allotropic transformation of iron from the body centered cubic lattice to the close packed, face centered cubic lattice on heating, and the reverse on cooling.

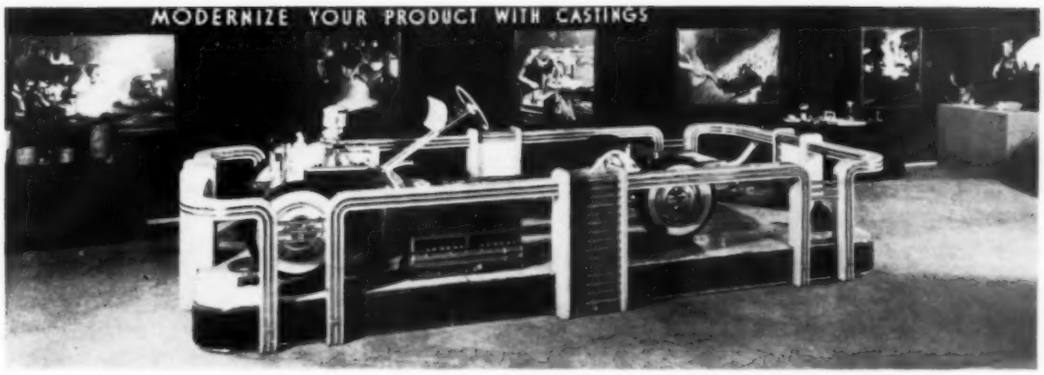
If the entire brake drum could be heated uniformly, normal thermal expansion would not be so important as it is in the case of a rapidly heated surface layer, say 0.005-inch thick, which attains temperatures in the range of 1400 to 1800 degrees Fahr., while the metal immediately beneath it is still at a temperature in the range of 70 to 300 degrees Fahr. Under these circumstances the heated surface layer expands while the cooler adjacent layers maintain their original dimension. The heated metal becomes weak in compression, while cold metal beneath it is strong and highly resistant to deformation.

This causes the surface (*Please turn to page* 83)

Table III

## Data on a Number of Brake Drum Compositions

| No. | C | Mn | Si | Cr | Ni | Mo | V | Remarks |
|---|---|---|---|---|---|---|---|---|
| 1 | 3.15–3.30 | | 2.00–2.20 | 0.20–0.35 | | 0.40–0.60 | | Used in truck brake drums<br>35 per cent silicon added to ladle |
| 2 | 3.20 | | 2.20 | 0.25 | | 0.70 | | Used in trailer brake drums |
| 3 | 3.30 | 0.63 | 2.21 | | | 0.36 | | |
| 4 | 3.40–3.60 | 0.80 | 1.60 | 0.50–0.75 | 1.75–2.25 | | | Used in large truck and bus brake drums |
| 5 | 3.38 | 0.71 | 1.81 | | | 0.55 | .16 | Used in bus brake drums<br>See test—BHN 217 |
| 6 | 3.60 | 0.70 | 1.90 | 0.50 | | 0.50 | | Silicon content usually adjusted to give 220-240 BHN on drum |
| 7 | 3.65 | | 2.00 | | | 0.50 | (Cu 1.50) | 35 per cent silicon added late |
| 8 | 3.45 | 0.60 | 2.20 | 0.30 | | 0.30 | | BHN 220 |
| 9 | 3.25 | 0.70 | 2.40 | | 0.75 | 0.75 | | Airplane brake drums |
| 10 | 3.75 | | | | 2.00 | 0.50 | | Airplane brake drums |
| 11 | 3.60–3.80 | 0.60–0.80 | 1.10–1.30 | | | 0.50 | | Used in braking disks on streamlined trains at BHN 207-228 |




# A·F·A

## CONVENTION REVIEWS

## PROGRESS ··· STUDIES FUTURE

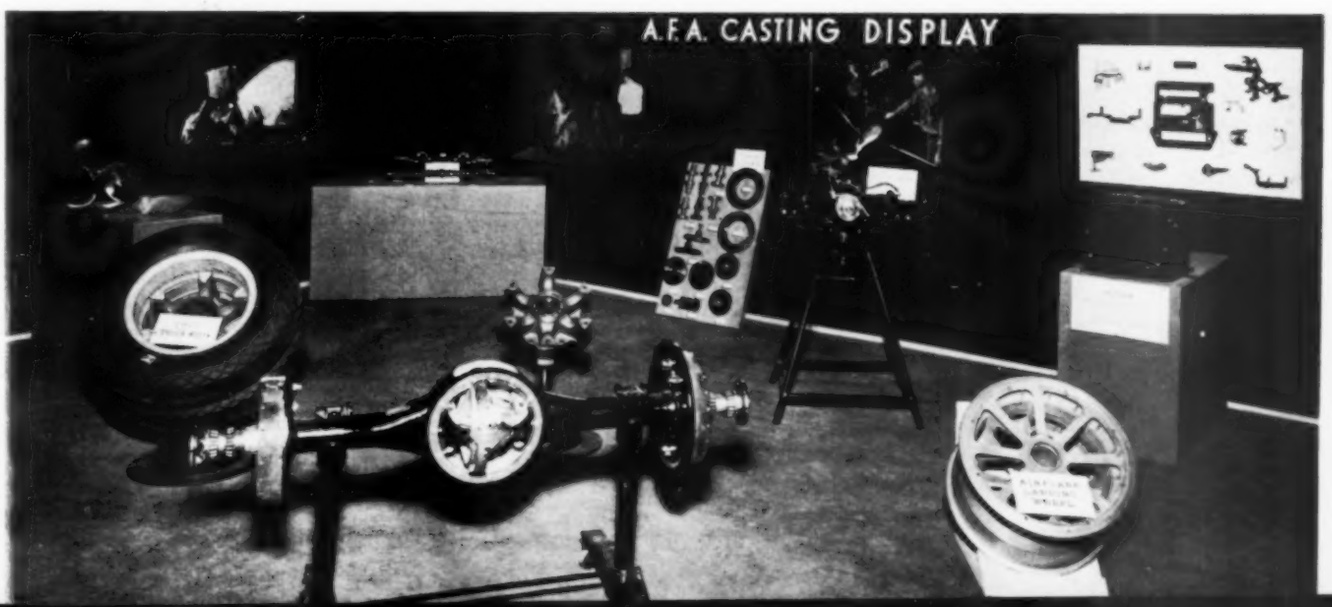
PROGRAM of events at the forty-fourth annual convention of the American Foundrymen's association, held in Chicago May 4 to 10, was so extensive that it was not possible to present all technical session reports in the June, post convention issue of THE FOUNDRY. For that reason, reports on the following sessions are presented in this issue: Apprentice training; foreman training; safety and hygiene; costs; refractories; gray iron shop course; sand shop course; sand research; patterns; plant equipment; and job evaluation.

A demonstration by microprojection of the growth of crystals proved a popular feature of the convention. This demonstration, conceived and developed by Dr. C. W. Mason, professor of chemical microscopy and metallography, Cornell university, Ithaca, N. Y., was made on several occasions.

Projecting on the screen what transpired under a microscope when certain nonmetallic materials change from the liquid to the solid state, Dr. Mason enabled the audience to observe crystal formation. Since the behavior of metals is known to be the same in general principle as that of nonmetals, it was not difficult for the observer to believe that he actually was witnessing the freezing of molten metals. The experiments were simple and served well to illustrate crystallization phenomena. Use of polarized light showed crystals in contrasting colors.

Illustrated in the demonstration was the formation of dendrites, segregation of impurities and other phenomena. Allotropic transformations, eutectics and numerous other cases of phase studies also were simulated. Dr. Mason similarly showed how plastic deformation or cold work causes grain growth by subjecting a specimen of lead to tension.

A safety program can be established and operated successfully by the small foundry, according to P. E. Rentschler, Hamilton Foundry & Machine Co., Hamilton, O., who spoke before the A.F.A. safety and hygiene session held Thurs- (*Please turn to page* 64)



# Questions and Answers

## Pins May Be Located on Cope Or on the Drag Flask

Do you know of any particular reason for attaching the guide pins to the drag of bench flasks, and to the cope of medium size floor flasks? This does not include flasks used on machines. An examination of foundry literature would seem to indicate that no conventional rule is followed. Placing of the pins merely represents personal preference. We have our own opinion on the subject, but will welcome further light on the subject.

If an ordinary run-of-mine opinion will serve your present purpose we might hazard the guess that convenience is the determining factor in placing the pins on a flask. Practically all bench patterns are mounted on pattern plates or follow boards. Obviously pin holes are more convenient than pins on a pattern plate. Since the drag is rammed first, the pins are placed on the drag to locate it properly on the plate. Flasks for floor work fall into a different category. The pattern may be bedded in, or the drag may be rammed on a plain rollover board which may or may not extend beyond the flask. In any case the pins are not needed, and in some instances might be in the way. Hence they are placed in the cope. Therefore, as mentioned previously, pin location is based on convenience.

## Ratio of Pig to Scrap Depends On a Number of Factors

What is the proper analysis and what is the proportion of pig iron and scrap for use in a foundry making a general line of machinery and stove plate castings?

In determining the proper analysis of finished castings and proportion of scrap and pig iron used in mixture, it sometimes is necessary to consider foundry location and scrap materials which are available and the cost of same, as compared to pig iron. A large number of foundries making stove plate castings do some jobbing work, such as light machinery and castings which can be made from stove plate iron with satisfactory results. It is necessary for some foundries to use all Southern iron, while in other locations where Northern iron is available, equal amounts of Northern and Southern are used in stove plate mixtures with very satisfactory results.

Iron which would be suitable for stove plate and light machinery should give analysis in finished product as follows: Silicon 2.25 to 2.60 per cent; sulphur, 0.06 to 0.086 per cent; phosphorus, 0.60 to 0.80 per cent; manganese 0.45 to 0.60 per cent; total carbon, 3.40 to 3.65 per cent.

With this range of analysis in the finished product it would not be hard to make a mixture within this range and while the average foundry uses 40 per cent pig and 60 per cent scrap, there are others using vice versa, 60 per cent pig and 40 per cent scrap.

Total carbon content should be given proper consideration for castings of this type, as best results would be obtained when using the higher limits on silicon working to a lower total carbon, to prevent some of the ordinary defects in the enameling plant with high total carbon and high silicon at the same time. The same is also true in light machinery castings made with stove plate iron.

While it is true that strength is not necessary in stove castings with modern cleaning equipment, it is necessary to have metal strong enough to prevent unusual breakage in both the cleaning and assembly room.

It is necessary to use care in the selection of scrap, as best results will be obtained in using a clean stove plate scrap or light machinery, with analysis which would compare favorably with the finished product, or with silicon above 2.00, and also free from burned and chilled iron, which will materially reduce the percentage of scrap in foundries making castings of this type.

## Fine Pinholes Cause Difficulty In Large Aluminum Plates

We are making some aluminum alloy plates 36 inches square and 1½ inches thick, we are having trouble eliminating very fine pinholes. Particular care is taken in ramming the molds, with the moisture of the sand, and venting. Aluminum is melted in a cast iron pot furnace with an oil burner. Pot holds 200 pounds and takes between 1¾ to 2 hours to melt. Pouring temperature is 1200 to 1285 degrees Fahr. We gate the casting from a U-shaped runner encompassing three sides of the casting. Single gates enter opposite sides of the casting from the lengths of the *U* while the sprue is located opposite the third side in the center of the *U*. Pouring sprue is 2 inches in diameter while two 3-inch risers are taken off the runner at the side gates.

Pinhole troubles evidently result from an accumulation of several causes rather than from a single one. In the first place, it appears that absorption of gas

might be one cause. You mention that it takes 1¾ to 2 hours to melt 200 pounds of aluminum. Figures available indicate that with a cold furnace a 300-pound pot takes about 1¾ hours and succeeding heats take 1¼ hours. A 100-pound pot with a cold furnace takes 75 minutes and succeeding heats about 60 minutes. Hence, your melting time should be somewhere between those two ranges.

Another cause of pinholing results from the admixture of air into the metal, due to methods of handling between melting pot and sprue opening of the mold. For instance, if the metal in the melting pot has to be dipped out into the pouring ladle, or it is poured from a great height into the pouring ladle, the agitation and disturbance causes the molten metal to absorb and hold in solution a considerable amount of air. The same thing may occur from pouring from a considerable height into the sprue of the mold. The air held in solution does not escape entirely before solidification takes place, and consequently pinholes may appear at the surface or just under the skin.

Another cause of the poor surface is lack of proper feeding. We believe that your gating system can be improved considerably so that any possible trouble from shrinkage will be eliminated. Your use of a *U* gate around three sides of the castings makes the metal travel a long distance. Gate from two opposite sides and pour from two ladles. Use sprues 3 inches in diameter with a strainer core at the bottom to act as a choke. Use an ample size runner extending almost the full length of the side of the casting, and from that cut four gates into the casting cavity on 9-inch centers starting at the extreme edge of the cavity. The gates should be of ample size and can be necked slightly where they are attached to the casting to aid in removal.

You should determine experimentally the exact and best temperature within just a few degrees. One way is to determine the lowest possible temperature at which to fill the mold satisfactorily, and then add 20 degrees just to insure against any slips. In some cases an allowance of 50 degrees above the lowest possible temperature is made.

## Cadmium Plated Insert Must Be Dry To Prevent Blowing

We are contemplating casting a cadmium plated steel insert in an aluminum casting and are wondering what reaction will take place between the cadmium and aluminum, and whether a protective coating should be employed. We are using secondary 8 per cent copper-92 per cent aluminum alloy.

While cadmium and aluminum do not alloy to any great extent, we believe that below 4 or 5 per cent, cadmium should not affect the aluminum. Therefore, you should not encounter difficulty with cadmium plated steel inserts except as far as the casting itself is concerned. It is claimed that cadmium lowers corrosion resistance of aluminum, and that of course, would be at the interface between the two. Consequently, we believe that the only precaution necessary is that required with any type of chill or insert, namely that it is absolutely clean and dry.

## One Type of Iron Not Suitable For Variety of Castings

We are running heats from 1800 to 2400 pounds in a cupola lined to 19 inches. The bed is 30 inches above the tuyeres, and the charge contains 100 pounds of pig iron and 200 pounds of scrap. Coke splits are 30 pounds and 15 pounds of limestone is used for fluxing. Blast is 4½ ounces, and a 2400-pound heat is melted in 55 minutes. Castings made from the iron run from 3 to 200 pounds of which many are machined. In the heat, we find three or four castings in which the metal is quite hard and white in fracture although the remainder of the heat is usually soft and easily machined. We find that when hardness occurs in castings, it sometimes is that way all through the casting while in another from the same heat it only may be on the surface of the casting. Sometimes in furnace grate bars we find that the runners are hard and the bars soft. Recently in some ferrules for connecting sections of hot water boilers, we had trouble with the gate drawing holes in the casting. We cut the gate at the casting down to ½-inch wide by ¼-inch deep, the gates being cut about the same, and half of the castings were lost. When the gate was broken off there was a hole in the casting. These ferrules are 4⅛ inches in diameter and 1½ inches high, and the metal is ⅜-inch thick.

The main difficulty is in trying to make one type of iron satisfy requirements of a wide range of section thicknesses. Hence, it will be necessary to change your procedure so that castings of one range of section thickness will be poured from a mixture suitable for that purpose and other castings of other section thicknesses be poured from other mixtures which will provide the required characteristics. In other words, a mixture suitable for a casting ¼-inch in thickness will not work out satisfactorily in a casting that is 1-inch thick.

It appears to us also that your charges in the small, 19-inch cupola are too large. We suggest that they be cut to one-half that size or 150 pounds. Also we believe that you are employing too little coke and too much limestone. With a 150-pound charge not less than 20 pounds of coke should be used to obtain good, hot iron. Iron charged into the furnace should be broken up to small pieces. In fluxing the average cupola charge, the amount of fluxing material ranges from 2 to 3 per cent of the weight of the iron charge, so that with a 150-pound charge, the limit of limestone would be about 5 pounds while with a 300-pound charge, the amount should be 9 pounds.

As pointed out previously, an iron mixture suitable for one range of section thickness will not be suitable for a heavier or lighter range of section thicknesses, and that seems to be indicated in your reference to grate bars. In the grate bars, your runner evidently is much smaller in section than the bar itself, and consequently, the runner will be harder than the bar. With the ferrule castings, we believe that the holes are caused by lack of feed. In other words the gates were too small in the first place, and matters were made worse by cutting down on the gate size. Try a gate 5/16 x 1-inch and we believe that you will not find any holes at the gate.

## Colors Silver with Sulphide Solution

We have noticed that silver or silver plated objects turn yellowish after some time, and in other cases after some use become a whitish gray. Presumably those colors result from formation of silver sulphide or chloride films, and we would like to know how we can secure those colors on silver plated ware.

Coloring silver or silver plated articles usually involves use of some sulphide solution. Depth of color, which in the final stage is black, will depend upon strength of solution used, temperature of solution, and length of immersion time. Further effects can be obtained by use of wire scratch brushing or tampico brushing with or without water, and with or without some abrasive material such as pumice.

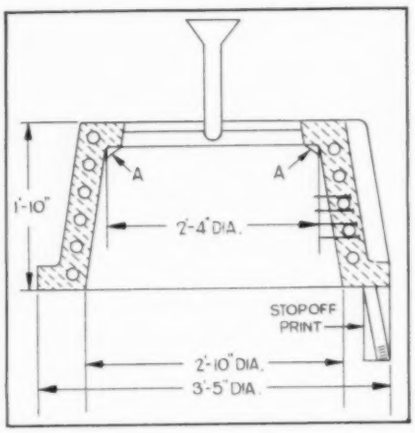
French gray, which is the color you evidently desire, is said to be obtained by employing a solution containing from ¼ to 2 ounces of potassium sulphide in sufficient water to make 1 gallon. Solution is used at 150 degrees Fahr., and the work is relieved on a nickel silver, wire scratch brush operating at 800 to 1000 revolutions per minute using pumice and water. You undoubtedly will have to do a little experimenting to determine the best solution strength and other operating features to obtain the exact effect you desire, but it will be well worth while.

## Long Pipe Coil in Cast Steel Tuyere

We have some cast steel tuyeres to make as shown in the accompanying drawing. We shall appreciate your opinion on the best method to adopt in molding and gating these castings to prevent the metal from melting the pipe coil.

Danger of melting the heavy pipe coil in the cast steel tuyere practically is nonexistent where the casting is molded flange down and gated at the top through a central sprue and six branch gates, as shown in the accompanying illustration. A small channel gate is cut in the shoulder in front of each gate as shown at *AA*. With this arrangement the metal will flow readily and rapidly into the mold, but the amount flowing through each gate will not be sufficient to melt the pipe in the immediate vicinity. This is a departure from the orthodox method of gating steel castings at the bottom, excellent in many instances, but highly unsuitable in the present instance.

If this casting was gated at the bottom, through one, two or even three passages, the entire amount of steel required to fill the mold would have to flow past the bottom coil. Further, from the beginning of the pouring process, the bottom coil would be immersed in a bath of hot, fluid steel, constantly augmented by fresh metal, and conceivably under these conditions the pipe might melt. With the top gate, only part of the metal from each branch will impinge on the pipe on its downward journey. In contact with the cold pipe at the bottom, the metal rapidly will lose temperature and remain perfectly innocuous so far as raising the pipe




Metal enters the mold through six branch gates fed from a central sprue

to the melting temperature is concerned.

The same is true of each succeeding unit of the coil as the metal rises in the mold. In the event that you are not familiar with the phenomenon, your attention is directed to the peculiar behavior of coils or other pipe shapes in molds. They are almost as difficult to hold in place as so many eels. In addition to the usual *lift* of the metal there is the natural expansion of the pipe, further complicated by the fact that it is softened by the heat and therefore easily distorted. Parts of the coil are just as likely to go down as to go up. Top and bottom chaplets should be provided with dished heads to anticipate a slight lateral movement of the pipe.

Under certain conditions it is feasible to place studs between the other sections of the coil. However, in the present instance, where the metal thickness in the wall is not excessive, a number of 6 or 7-inch spikes driven into the core as shown at *B* will hold the coils in place. These spikes should be driven in six vertical areas, each area between two of the branch gates. We assume that the mold is dried, and therefore the wall is hard.

## Flour Is Used as Bonding Agent

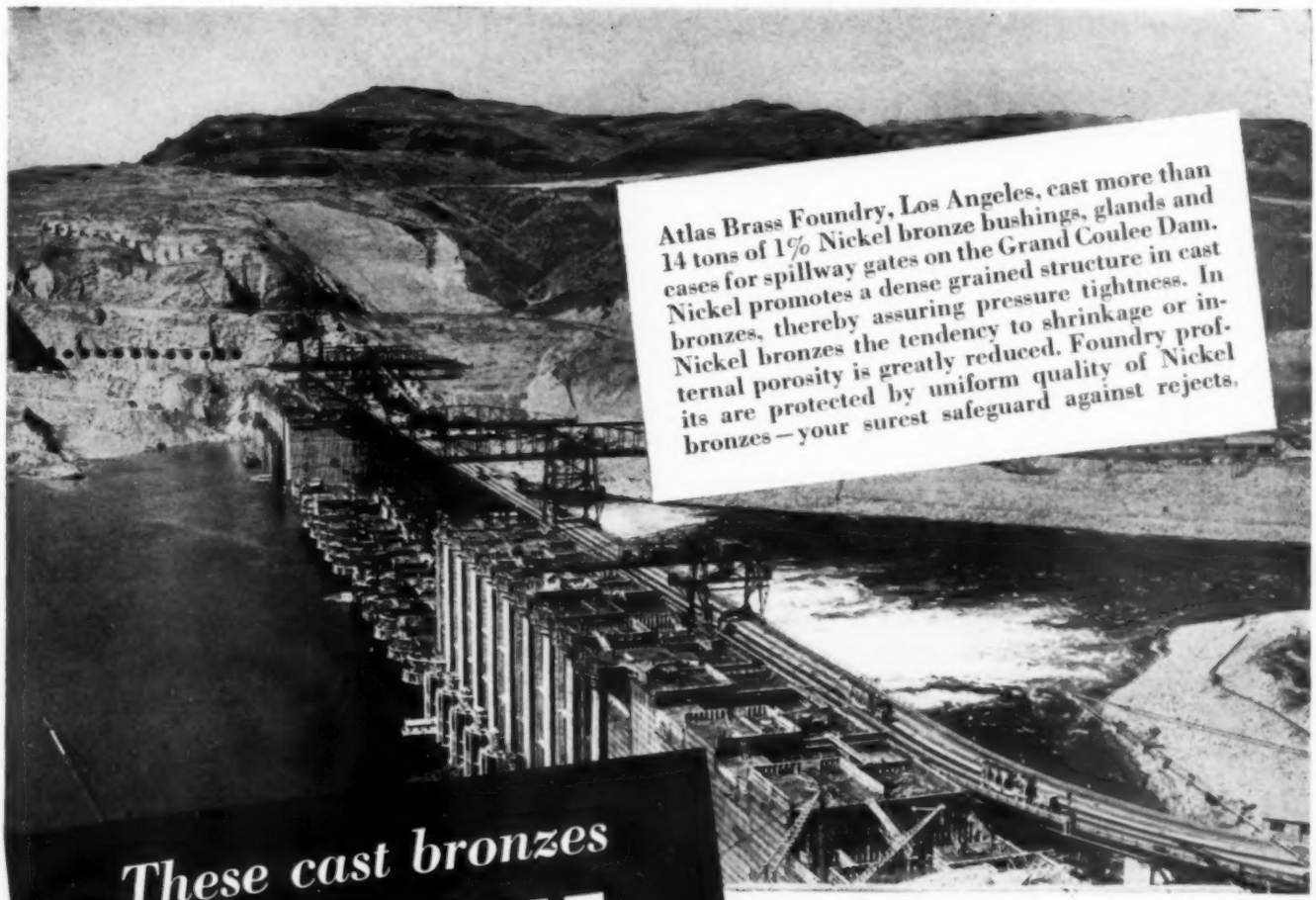
Can you tell us just what is the effect of flour additions to core and molding sands? Does it have a tendency to burn out—thus opening the sand, or is it primarily a binder? We have been using some in a rather fine core sand, but it seems to have aggravated our trouble. What would you recommend as a good core mixture for bushing cores where the metal thickness ranges from 1 to 3 inches?

So far as we know, flour additions are made to core and molding sand primarily as a bonding agent to provide green bond or strength. In some cases the mold face is dusted with flour which is claimed to give a better color on brass and bronze castings.

You do not mention what your trouble has been, but you state that you are employing fine grain core sand which leads to the opinion that you are having difficulty with blows. That trouble may be due to a number of factors rather than one although we believe that you will have much better success by opening up your sand—going to a medium grain rather than fine. If the resulting surface is not smooth enough, you can coat the core with a thin coating of graphite or with any of the prepared coating compounds available for that work. Possibly you may be using too much bond in the sand. Use only enough bonding or binding agent to provide the necessary strength for handling since the lower the amount of bond, the lower the amount of gases formed.

In the case of small cores, leave a vent opening completely through the center which is large enough to carry away the gases, and see that the vents from the core are taken off to the exterior surfaces of the mold. The place in particular to watch is the bottom or drag side when bottom boards are used since those when applied tightly do not allow gases to escape easily and scratch vents should be made to the edges of mold and bottom boards. In the case of large diameter cores, it is advisable to hollow out the center and fill the opening with cinders, sawdust, etc. to insure a permeable center.

You do not mention what particular mixture you are using at present for the cores, but it appears to us that a straight oil sand mixture should serve satisfactorily. Your present core oil supplier undoubtedly will be glad to assist you in determining proper ratio of oil to sand, and baking time. Use a good quality, clean core sand, and mix it with oil in the ratio of 1 part of oil to 60 parts of sand.



Atlas Brass Foundry, Los Angeles, cast more than 14 tons of 1% Nickel bronze bushings, glands and cases for spillway gates on the Grand Coulee Dam. Nickel promotes a dense grained structure in cast bronzes, thereby assuring pressure tightness. In Nickel bronzes the tendency to shrinkage or internal porosity is greatly reduced. Foundry profits are protected by uniform quality of Nickel bronzes—your surest safeguard against rejects.

# *These cast bronzes* EASILY BEAT SPECIFICATIONS

## *...aided by* NICKEL

Coupling cases, stuffing boxes, nut tube glands and hub glands cast in 1% Nickel bronze by the Atlas Brass Foundry. These were used by Consolidated Steel Corporation, Ltd., Los Angeles, in fitting 8½′ gate valves for the Grand Coulee Dam. Average tensile values from fifteen test bars exceeded specifications by more than 33%.

The improved strength and toughness of Nickel brasses and bronzes permit more compact designs. Though strong and tough, Nickel alloyed bronze materials are readily machinable. Using the right Nickel alloys in the right places will make foundrymen, shop men and customers 100% happier. Consultation on your problems is always welcomed.

1. *Coupling Cases*
2. *Stuffing Boxes*
3. *Nut Tube Glands*
4. *Hub Glands*

**THE INTERNATIONAL NICKEL COMPANY, INC.** 67 WALL STREET NEW YORK, N. Y.

# MEN of INDUSTRY

W. CARTER BLISS, works manager, Scullin Steel Co., St. Louis, was elected chairman of the St. Louis District Chapter, A.F.A. recently. Mr. Bliss was born in St. Louis, April 7, 1893 and attended public schools and the Soldan high school in St. Louis, graduating in 1912. He attended Washington university, St. Louis, from 1912 to 1914, taking a course in mechanical engineering, and was graduated from Cornell university, Ithaca, N. Y., in 1917 with a degree of mechanical engineer. Mr. Bliss then attended the second officers training camp at Fort Sheridan, Ill., and was commissioned second lieutenant in the ordnance department, serving 16 months in France. He was promoted to captain and awarded the purple heart for work at the International Ordnance depot No. 2, Gievres, France. After the war he became engineer, mill department, Scullin Steel Co., and in 1922 was made assistant superintendent of foundry. He was made works manager in 1934. Mr. Bliss is a member of the American Society of Mechanical Engineers, Army Ordnance association, and American Foundrymen's association. He has been active in the work of the St. Louis chapter, and served as vice chairman during the past year.

♦ ♦ ♦

JOHN SLEZAK recently was elected president, Turner Brass Works, Sycamore, Ill. Mr. Slezak has been vice president and general manager of the concern since 1931. The company will celebrate its seventieth anniversary in 1941.

♦ ♦ ♦

STANLEY M. MERCIER recently was appointed chief engineer, conveyor division, Jeffrey Mfg. Co., Columbus, O., and will direct all conveyor engineering and engineering sales activities. Born and educated in England, Mr. Mercier has had a varied experience in industrial and construction engineering, design and sales.

♦ ♦ ♦

MAX F. BECKER recently was appointed vice president in charge of sales representatives, Whiting Corp., Harvey, Ill. Mr. Becker started with the Whiting Corp. in June, 1920, after graduation from Purdue university, West Lafayette, Ind., and first served with the pulverizer division. After several years in various departments he was made manager of the Whiting foundry equipment division and last year was made sales manager of the industrial division under C. Q. WRIGHT JR., vice president in charge of sales. In his new capacity, Mr. Becker will be in direct charge of field men in the industrial division.

♦ ♦ ♦

GERALD E. STEDMAN recently was made sales manager, Rego division, Bastian-Blessing Co., Chicago.

♦ ♦ ♦

WALTER B. SLATERY has joined the staff of the Hercules Powder Co., Wilmington, Del., and will be engaged in technical sales work in connection with the resin core binder made by that company. Mr. Slatery became connected with the foundry industry in 1909 when he was employed by the Muncie Foundry & Machine Co., Muncie, Ind. In 1920 he

(*Concluded on page* 42)

W. Carter Bliss

John Slezak

Max F. Becker

Stanley M. Mercier

*Airplane View of Properties of*

# WOODWARD IRON COMPANY

WOODWARD, ALABAMA

■ Woodward Iron Company is the only merchant iron producing concern in the world where both the coal mines and ore mines may be seen from the furnace top. Eastern and western sections of Woodward's properties contain the two basic raw materials—coal and ore. These are brought together by 26 miles of main line and 56 miles of Woodward owned railroad, to a central location by the limestone deposits where coke ovens, blast furnaces and supplementary plants and equipment are located. There is no other spot in the world where such an arrangement is possible.

*America's Largest Completely Integrated and Entirely Independent Merchant Iron Producer*

INDEPENDENT SINCE 1883

(*Concluded from page 40*)

completed a special foundry course at Carnegie Institute of Technology, Pittsburgh, and from 1932 to 1935 was connected with Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich. From 1935 to 1939 he was employed by S. Obermayer Co., Chicago, as sales engineer.

♦ ♦ ♦

E. H. ANCHORS, formerly branch manager at Atlanta, Ga. for Air Reduction Sales Co., New York, recently has been appointed manager of the Oklahoma City district.

♦ ♦ ♦

C. K. BRYCE has been elected vice president, Oxweld Acetylene Co., a unit of Union Carbide & Carbon Corp., New York.

♦ ♦ ♦

T. D. CARTLEDGE and L. A. BLISS have been elected vice presidents and E. J. HAYDEN has been made vice president, Central division, the Linde Air Products Co., a unit of Union Carbide & Carbon Corp., New York.

♦ ♦ ♦

J. S. BENNETT has been made manager of sales, American Engineering Co., Philadelphia. WILLIAM H. SCHULTZE has been made manager of the marine division and C. L. MYERS will continue as sales manager of the stoker division.

♦ ♦ ♦

WILLIAM R. HOYT, works manager, Yale & Towne Mfg. Co., Stamford, Conn., has been promoted to general manager, Stamford division. He succeeds RICHARD G. PLUMLEY, resigned. Mr. Hoyt has been associated with the company 38 years serving successively as foreman, departmental superintendent, superintendent of production, assistant to the vice president on production and comptroller of production. In 1930 when the materials handling division was transferred to Philadelphia, Mr. Hoyt was made works manager.

♦ ♦ ♦

R. T. YATES has been made manager of domestic sales of the naval stores department, Hercules Powder Co., Wilmington, Del., and D. M. HOUSTON has been appointed manager of naval stores export sales.

♦ ♦ ♦

ED. J. SKINNER recently was appointed factory superintendent, Renown Stove Co., Owosso, Mich., succeeding the late Claude J. Sperry. Mr. Skinner has been connected with the Renown company since 1909. For 15 years he was foreman of the assembly department and for the past 2 years has been assistant factory superintendent.

♦ ♦ ♦

RAY B. O'CONNELL, Ohio Steel Foundry Co., Lima, O., recently was elected chairman of the foundry section, All Ohio Safety Congress and Exhibit for 1941. L. A. YOUNG, American Rolling Mill Co., Middletown, O., was elected vice chairman, and A. F. SCHULTZ, American Radiator & Standard Sanitary Corp., Elyria, O., was made secretary.

♦ ♦ ♦

MARTIN J. O'BRIEN SR., for the past 13½ years foundry superintendent, Gould Coupler Co., Depew, N. Y., recently resigned. Previous to that connection Mr. O'Brien was with the American Steel Foundries, Commonwealth plant of General Steel Castings Corp., Canadian Car & Foundry Co., and the Scullin Steel Co. in the same capacity.

Martin J. O'Brien Sr.

♦ ♦ ♦

HAROLD C. ROWE is president and treasurer of the Rowe Foundry Co. Inc., Florence, Mass., recently formed to operate the Norwood Foundry Co. The company will do a general line of jobbing work. Mr. Rowe has had 25 years' experience in the industrial management and accounting field, 17 of which were spent in the gray iron foundry business.

♦ ♦ ♦

STEWART E. LAUER, president, York Ice Machinery Corp., York, Pa., recently was elected president, Air Conditioning Manufacturers association. Other officers elected are: Vice president, STUART M. CROCKER, manager, air conditioning department, General Electric Co.; treasurer, P. A. MCKITTRICK, general manager, Parks-Cramer Co., Fitchburg, Mass.

♦ ♦ ♦

HAROLD S. STROUSE, treasurer, Harnischfeger Corp., Milwaukee, has been elected chairman, Electric Hoist Manufacturers' association, New York. Mr. Strouse succeeds W. W. PEATTIE, Northern Engineering Works, Detroit. F. F. SEAMAN, general manager, Robbins & Myers Inc., hoist and crane division, Springfield, O., has been appointed vice chairman of the association.

♦ ♦ ♦

GEORGE W. PERSON, sales engineering department, Norton Co., Worcester, Mass., has been transferred to the St. Louis territory for special grinding wheel service. He will assist the present representative ARTHUR W. COX and co-operate with several Norton distributors. J. L. DEVOU JR. has been appointed field engineer in Cleveland, and GEORGE L. FREEMAN has been named to the same position in Chicago.

♦ ♦ ♦

WARREN A. COOK, division of industrial hygiene and engineering research, Zurich Insurance Co., Chicago, recently was elected president of the American Industrial Hygiene association. GORDON C. HARROLD, industrial hygiene laboratories, Chrysler Corp., Detroit, was re-elected secretary.

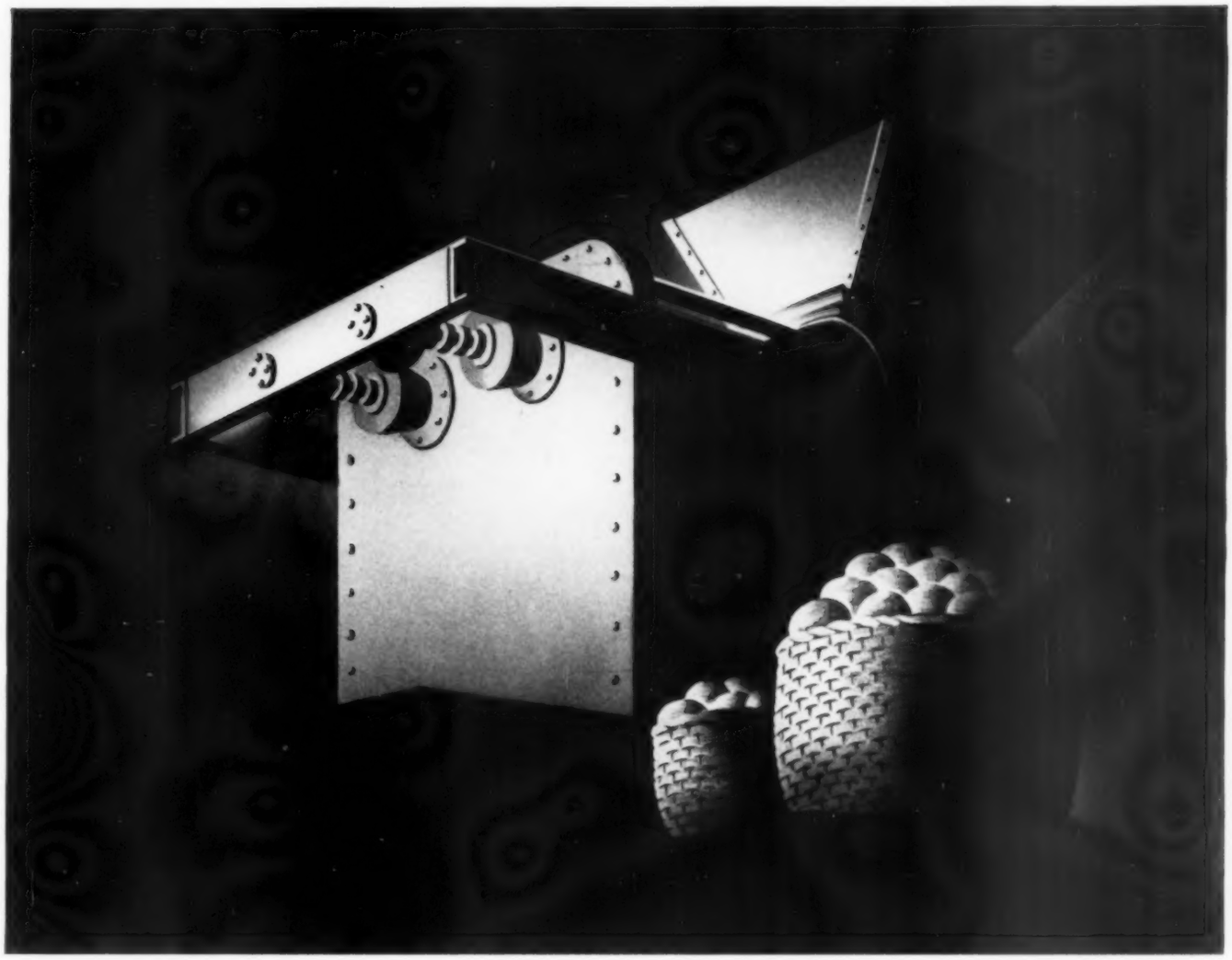
♦ ♦ ♦

DR. LEROY U. GARDNER, director, Saranac Laboratory for the Study of Tuberculosis, was awarded the William S. Knudsen plaque for outstanding achievement in industrial medicine at the recent joint meeting of the American Association of Industrial Physicians and Surgeons and the American Industrial Hygiene association. For 11 years Dr. Gardner has made an intensive study of silicosis, causes, treatment, and methods of prevention.

♦ ♦ ♦

OSCAR E. HARDER, assistant director, Battelle Memorial institute, Columbus, O., has been nominated as president of the American Society for Metals. BRADLEY STOUGHTON consulting engineer, Lehigh university, Bethlehem, Pa. is the nominee for vice president and WILLIAM H. EISENMAN, Cleveland, has been nominated to succeed himself as secretary for 2 years. Nominated as trustees for 2 years are: CHARLES Y. CLAYTON, professor of metallurgical engineering, Missouri School of Mines, Rolla, Mo.; and E. L. BARTHOLOMEW, metallurgist, United Shoe Machinery Corp., Beverly, Mass. Election will be held at the National Metal congress in Cleveland, Oct. 21-25.

Oscar E. Harder



# MEETING A THREE-WAY DEMAND

A large fruit juice extractor looks so simple that there would not appear to be any special problems in the selection of materials for its parts. Yet, the screw must stand high pressures, and tramp iron can cause serious trouble. Ripe fruit won't wait for machine repairs.

Because it meets all three demands of the service so well one manufacturer of extractors now uses nothing but cast Carbon-Molybdenum steel for the screws. The steel (1) develops the requisite strength and toughness when normalized; (2) is comparatively inexpensive and (3) permits easy reconditioning when it is finally required — the worn spots being built up by welding and re-machined to original dimensions.

Here, then, is another case where the use of modern materials has economically achieved a distinct product benefit. There may be similar opportunities in your own product. Our book, "Molybdenum in Steel", which is sent free on request will help you find them.

PRODUCERS OF MOLYBDENUM BRIQUETTES, FERRO-MOLYBDENUM, AND CALCIUM MOLYBDATE

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MOLY

## Wisconsin

TWENTY-FIVE of the 30 Wisconsin foundrymen, who have completed a half century or more in the foundry industry, were honored guests of the Wisconsin Chapter of the A. F. A., May 17, at the Schroeder hotel, Milwaukee. Combined foundry experience of the group, majority still active, amounts to over 1500 years. Ed Borgnis, the riding young lone ranger with 54 service rings on his horns introduced each member of the group in a series of witty and eulogistic thumb nail sketches that brought modest blushes to the cheeks of the recipients and enthusiastic applause from the audience. Names of the veterans, year they started their apprenticeship and connections follow:

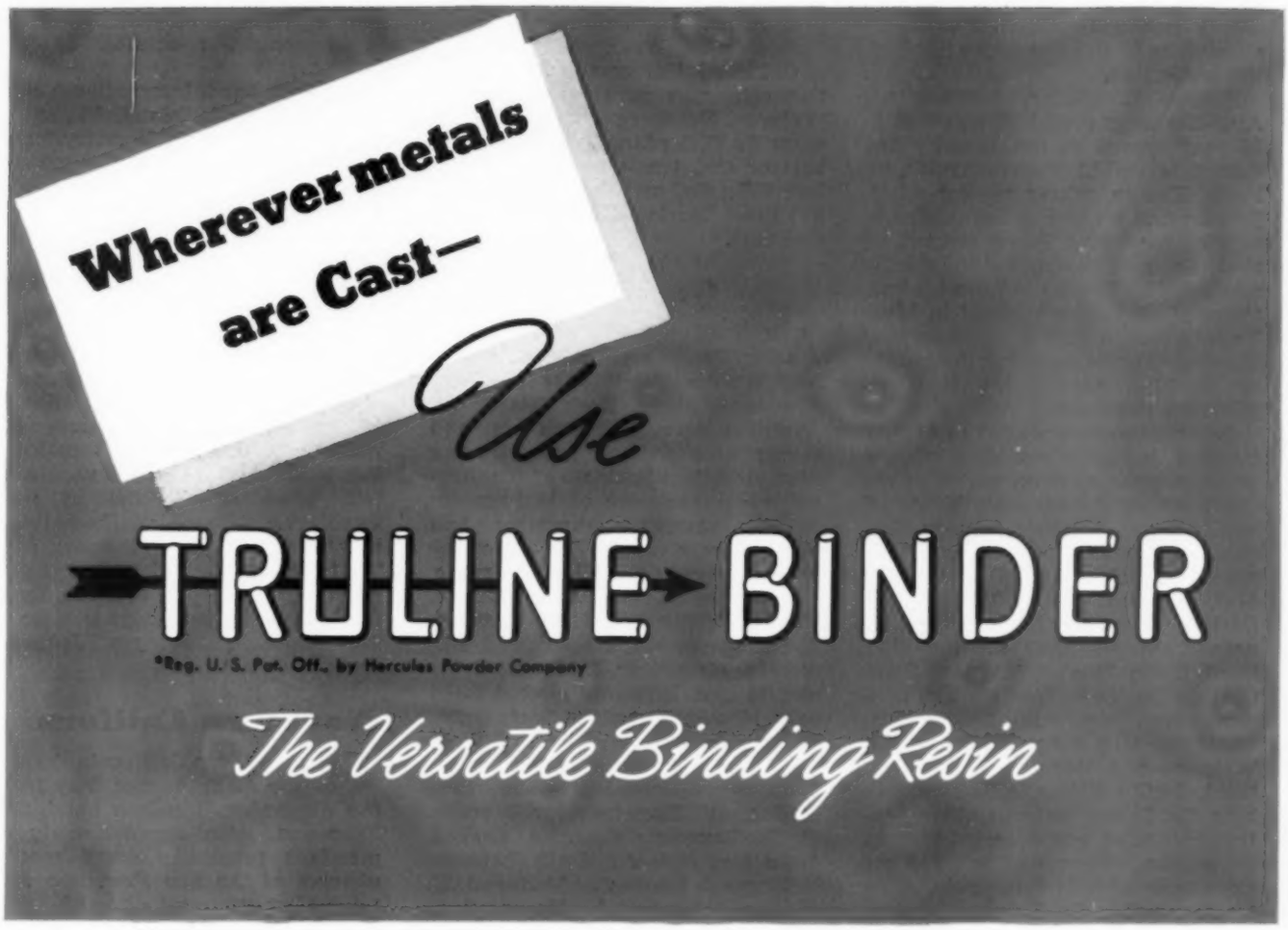
David McLain, 1873, McLain's System, Inc.; Eugene Kueny, 1875, Allis-Chalmers; George Klenk, 1877, Allis-Chalmers, (retired); J. A. Anderson, 1880, Bucyrus-Erie Co.; Ole Arneson, 1880, Arneson Foundry, Kenosha; W. J. Adams, 1881, Donald Sales & Mfg. Co.; A. E. Harrison, 1881, Allis-Chalmers, (retired); George Geiger, 1882, Allis-Chalmers; E. M. Gladfelter, 1882; Bucyrus-Erie Co.; George Haberkorn, 1882, National Brake & Electric, (retired); John Ryan, 1882, Allis-Chalmers, (retired); J. W. Chambers, 1884, Bucyrus-Erie Co.; Theodore Mohr, 1884, Harnischfeger Corp.; J. B. Rountree, 1884, Bucyrus-Erie Co.; Henry Tietjen, 1884, Harnischfeger Corp.; Robert Ziebell, 1885, Universal Foundry Co., Oshkosh; Ed. Borgnis, 1886, International Molding Machine Co., (retired); Joseph Freisinger, 1886, Allis-Chalmers; A. J. Ricker, 1886, Badger Malleable & Mfg. Co.; John Hy Champion, 1888, Nordberg Mfg. Co.; Thomas Glasscott, 1888, Pickands, Mather & Co.; A. T. Helgerson, 1888, D. J. Murray Co., Wausau; John Leisk, 1889, Allis-Chalmers; C. E. McArthur, 1889, Vilter Mfg. Co. (retired); Joseph Placzek, 1889, Chain Belt Co.; Frank T. Becker, 1890, Becker Mfg. Co.; Ed. Freeman, 1890, George J. Meyer Mfg. Co.; W. F. Hoernke, Wisconsin Appleton Co.; J. J. McDevitt, 1890, S. Obermayer Co.; Martin Pusch, 1890, Allis-Chalmers.

Dean of all foundrymen present was David McLain, engaged for the greater part of the past 40 years in raising the standards of foundry practice in this and many foreign countries. Several years ago he was honored by election to honorary life membership in the Institute of British Foundrymen. At the Detroit convention of the A. F. A., in 1936 he was elected to life membership in the association and was presented with the J. H. Whiting gold medal in recognition of outstanding service to the association and to the foundry industry.

Although shrouded in the mists of antiquity it is alleged that Dave was born, successfully in Belfast in what is now His Brittanic Majesty's loyal Irish province of Ulster. Before he had time to acquire the local broad Scottish accent, his father whisked the family to America. At 10 years of age Dave commenced twisting hay rope for core barrels in Smith's pipe foundry in Pittsburgh. At 21 he was married and had charge of a foundry. Around the turn of the century he assumed charge of an important foundry in Milwaukee and a few years later established a consulting and correspondence institute for teaching foundry practice. Today, dapper and

(*Continued on page* 46)

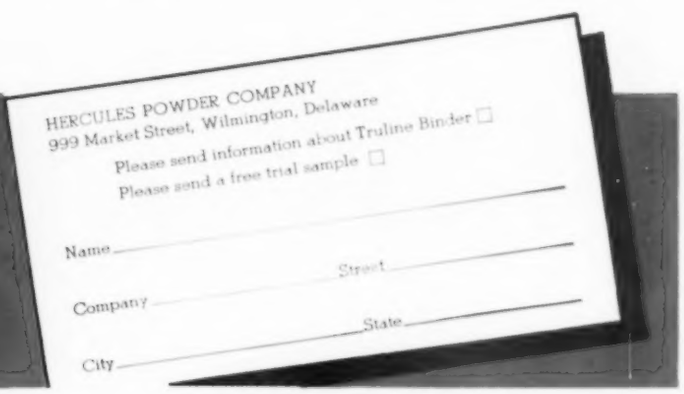
Front row reading from left to right: George Klenk, James Roundtree, Walter Adams, George Haberkorn, Andy Anderson, Joe Placzek, Ole Arneson, David McLain, Tom Glasscott, Robert Ziebell, Frank Becker. Second row: C. E. McArthur, John Ryan, Eugene Kueny, Ed. Freeman, Martin Pusch, A. T. Helgerson, George Geiger, John Leisk, J. W. Chambers, A. J. Ricker, Ed. Borgnis, J. J. McDevitt, E. C. Gladfelter




*To save money,* and to turn out better castings, wise foundrymen are bonding their cores with Truline* Binder, the versatile binding resin. With this low-cost controlled-quality binder, black sand can be used to good advantage. Baking times are reduced. Cores can be made and stored without warpage or excessive moisture pick-up. And castings come out free of sand, saving time and money on the cleaning floor.

*Better castings* result. Truline resin-bonded cores resist moisture, yet stand up to the surge of hot metal and burn out quickly with little gas evolution. Thus, cores stay true to form during pouring, and are free to collapse as the metal shrinks. Foundries using Truline Binder in their cores have few if any rejects due to scabbing or to shrinkage cracks.

*In mold-facings and core wash* as well as in cores, Truline Binder is demonstrating its value by saving money and improving the quality of finished castings. Many foundries, iron, steel, and non-ferrous, are cashing in on the versatility of this low-cost, easily handled resin by using it throughout their plants. You can, too. Write for more information and a trial sample.



ADVERTISING PAGES REMOVED

(*Continued from page* 44)

elegant, he is still the active head of the institution.

Eugene L. Kueny, foreman at Allis-Chalmers since 1921 and with a 65 year record in the foundry industry, served his apprenticeship in Paris, France, where among other jobs he had a hand in the construction of the Eiffel Tower erected in that city, and the statue of Liberty presented by France to America and unveiled on Bedloe's island in New York harbor in 1886. J. A. Anderson, Bucyrus-Erie Co., entering the foundry in 1880, served his time in Hjorring Denmark.

Other business attended to at this meeting included awarding of apprentice contest prizes, report of retiring officers and installation of new officers. William Watson, Jr., chairman apprenticeship committee presented prizes as follows: Steel, first, William Silber, Sivyer Steel Casting Co.; second, Robert Jablonowski, Sivyer Steel Casting Co.; third, Harry Nowak, Maynard Steel Casting Co. Gray iron contest winners, first, Kenneth Zinda, Allis-Chalmers Mfg. Co.; second, Walter Wojciehowski, Harnischfeger Corp.; third, Philip Karas, Allis-Chalmers Mfg. Co. In the patternmaking contest first prize was awarded Marvin Bergstrom, Kearney & Trecker Corp.; second to Melvin Crain, Allis-Chalmers Mfg. Co. Two third prizes were awarded one to Richard Albrecht, Allis-Chalmers Mfg. Co., and the other to Lyle Grotelueschen, Chain Belt Co. In the nonferrous group first prize was won by John Hayeland, Allis-Chalmers Mfg. Co.; second by George Radulovich, Ampco Metal Inc.; and third by Steve Garbowitz, Allis-Chalmers Mfg. Co. Four boys were national prize winners at Chicago as reported in the June issue of THE FOUNDRY.

Officers elected for the coming year include B. D. Claffey, General Malleable Co., Waukesha, president; A. C. Ziebell, Universal Foundry Co., Oshkosh, vice president; Howard Waldron, Nordberg Mfg. Co., secretary; R. F. Jordan, Sterling Wheelbarrow Co., treasurer; Fred Pritzlaff, Falk Co., and D. C. Zuege, Sivyer Steel Casting Co., were elected directors.

## Quad City

ANNUAL meeting of the Quad-City Chapter of the A. F. A. was held Monday, May 20 at the Fort Armstrong hotel, Rock Island, Ill. Approximately 75 members and guests were present, with Herman Alex presiding. Business of the chapter was taken care of and reports of the various committees and officers were made. The following officers were elected: Chairman, Nathan Lesser, Deere & Co., Moline, Ill.; vice chairman, A. H. Putnam, A. H. Putnam Co., Rock Island, Ill.; secretary-treasurer, J. Morgan Johnson, Moline. Directors elected for 1 year, Hyman Bornstein, Deere & Co., Moline; Frank W. Wells, J. I. Case Co., Rock Island; F. O. Gorman, John Deere Spreader Works, East Moline, Ill. Directors for 2 years, P. T. Bancroft, Republic Coal & Coke Co., Moline; E. C. Wussow, Williams & White Co., Moline; J. H. Ploehn, French & Hecht, Inc., Davenport, Iowa. Directors for 3 years, A. E. Hageboeck, Frank Foundries Corp., Moline; L. E. Roby Jr., Peoria Malleable Castings, Peoria, Ill.; and Ray Wendland, International Harvester Co., Rock Island, Ill.

Presentation of local prizes in the Quad-City apprentice contest were made by J. H. Ploehn, chairman, educational committee of the Tri-City Manufacturers' association, as well as two prizes won by apprentices of the Quad-Cities, in the national contest sponsored by the A. F. A.

Ray Wendland, International Harvester Co., Rock Island, Ill., spoke on "Training in the Foundry," giving the history in industry and the importance of quality, profit and self perpetuation. Because of the numbers employed in manufacturing, and the need of suitable personnel for supervision and skills, it behooves us to train men into the positions of the industry. Young men are given this opportunity by trial period in a trade of some line of the craft to set his mind. This period is of vital importance because the young man is becoming acquainted this is his life's work. He should be told what is expected of him, familiarize himself with policies, and become known to the men with whom he has to work. All of this is an important step in training. Practical work and knowledge is of great importance.—*J. Morgan Johnson, secretary-treasurer.*

## Northern California

THE Northern California chapter of the A. F. A. met May 10 at the Alexander Hamilton hotel, San Francisco, with approximately 40 members present. Colored motion pictures of the San Francisco fair, taken last summer, directed attention to its re-opening and a short film of Bill Reed, deep sea diver, in action, was shown. S. D. Russell, Phoenix Iron Works, Oakland, Calif., and chairman of the chapter, after announcing the annual meeting and ladies night, introduced the principal speaker, A. Lee Bennett, sales engineer, Gladding McBean & Co., clay products manufacturers of San Francisco and Pacific coast.

Mr. Bennett led up to his subject

(*Continued on page* 49)

Apprentice winners at the May 17 meeting of the Wisconsin chapter, reading from left to right: Front row, Harry Nowak, George Radulovich, Lyle Grotelueschen, William Watson, chairman of contest, Marvin Bergstrom, Richard Albrecht, Bob Ashley. Back row, Robert Jablonowski, Melvin Crain, Phillip Karas, John Hayeland, Walter Wojciehowski, Steve Garbowitz, William Silber, Kenneth Zinda, Ernest Klessig

(*Continued from page* 46)

by interesting references to the primitive art of working clay, on through the changes which have taken place, and then he passed for inspection samples of the products scientifically developed for many uses. During the speaker's talk, several questions brought out the advantages offered by more knowledge of the subject.

Clarence Henderson, Macaulay Foundry Co., first chairman of the chapter, and Dean of Northern California foundrymen, reported a recent vacation trip by air over Hoover dam.—*George L. Kennard, secretary-treasurer.*

## Buffalo

RADIOGRAPHY was the subject of discussion at the May 17 meeting of the Buffalo Chapter of the A. F. A. Dinner at 6:30 was followed by a clever magician, William J. Wahl. W. J. Corbett, Atlas Steel Casting Co., Buffalo, and chairman of the chapter presided, and approximately 75 members were present. Charles W. Briggs, Steel Founders' society, Cleveland spoke on "Radiography," illustrating his interesting talk with slides.—*J. R. Wark, secretary.*

## N. Ill. and S. Wis.

ELECTION of officers was held at the May 14 meeting of the Northern Illinois and Southern Wisconsin chapter of the A.F.A. held at the Hotel Hilton, Beloit, Wis. The following were elected for the coming year: Chairman, P. A. Paulson, Gunite Foundries Corp., Rockford, Ill.; vice chairman, H. C. Winte, Fairbanks, Morse & Co., Beloit, Wis.; secretary-treasurer, R. W. Mattison, Mattison Machine Works, Rockford, Ill.; technical secretary, J. R. Cochran, Sundstrand Machine Tool Co., Rockford, Ill. Directors elected for 3 years: G. J. Landstrom, Sundstrand Machine Tool Co., Rockford, Ill.; C. V. Nass, Fairbanks, Morse & Co., Beloit, Wis.; Fred N. Rundquist, Beloit Iron Works, Beloit, Wis.

Approximately 55 members and guests were present to hear C. O. Thieme, chief metallurgist, H. Kramer & Co., Chicago, discuss nonferrous alloys. The great improvement of physical characteristics during the past 20 years, and the practice used to effect the change, was shown. Mr. Thieme discussed the present trend to replace tin in nonferrous alloys, or at least a part, with some other metal. Because of the uncertain conditions prevailing with respect to tin and nickel, the trend is toward a copper silicon alloy. Castability and melting practices were covered. The talk proved interesting and promoted a lively discussion.—*Henry C. Winte, vice chairman.*

## Southern California

FOUNDRY sands was the subject discussed at the May 17 meeting of the Southern California Chapter of the A. F. A. Approximately 70 members and guests were present, with A. G. Zima, International Nickel Co., and chairman of the chapter, presiding. A short business meeting was held and all committees reported on their work for the year. Norman MacKay, Film Exhibitors exchange, gave a short history of baseball and then showed the picture, "Play Ball America," which included many of the National league greats and gave a lot of information on inside baseball. W. G. Reichert, metallurgist, American Brake Shoe & Foundry Co., Mahwah, N. J., gave a fine talk on foundry sands, and led a most interesting discussion on that topic. He described the various characteristics of foundry sands and how by controlling them certain results could be obtained.

It was decided to hold the summer outing in July, but no date or place was set pending appointment of the entertainment chairman and committee.—*W. F. Haggman, secretary.*

Views taken at the Foundry Conference held in East Lansing, Mich., earlier this year. Top—R. Schneidewind, University of Michigan, Ann Arbor, Mich., addressing one of the meetings. Seated on platform is Chairman R. G. McElwee, Vanadium Corp. of America, Detroit. Below—Speakers' table at the annual dinner. Harry W. Dietert, Harry W. Dietert Co., Detroit, and chairman of the Detroit chapter is at right. Photos courtesy A. H. Allen

## Northeastern Ohio

WITH approximately 200 members and guests present at the Tudor Arms, Cleveland, May 16, the Northeastern Ohio Chapter A.F.A. concluded the current year's activities with an extensive program including election of officers, presentation of prizes in the apprentice contest, an address by Rev. William O'Donnell on the crime situation in Ohio, and a technical paper by R. K. Glass, metallurgist Republic Steel Co., Buffalo, "Defective Castings, Their Causes and Remedies."

New officers and directors for the coming year include: President, F. Ray Fleig, Smith Facing & Supply Co.; vice president, Frank J. Dost, Sterling Foundry Co., Wellington, O.; secretary, Ben F. Lambert, Diamond Alkali Co.; treasurer, Russell F. Lincoln, Osborn Mfg. Co. A change in the by-laws increased the number of directors from 9 to 15. For 1 year, Sterling N. Farmer, Sand Products Co., Frank Opatrny, Frederic B. Stevens Co.; for 2 years, William J. Feth, Forest City Foundries Co., John C. Maher, Ohio Foundry Co.; for a 3-year term, William Goebert, Bowler Foundry Co., James G. Goldie, Cleveland Trade School, Ernest F. Hess, Ohio Injector Co., Wadsworth, O., Walter O. Larson, W. O. Larson Foundry Co., Grafton, O., John H. Tressler, Hickman, Williams & Co.

Walter L. Seelbach, Forest City Foundries and president Associated Industries of Cleveland, presented the prizes won by students of the Cleveland Trade School in the recent local molding and patternmaking contest and L. P. Robinson, Werner G. Smith Co., Cleveland, presented prizes in the contest conducted by the American Foundrymens' association. In the local gray iron molding contest first prize was awarded to Chester Blacksmith, Bowler Foundry Co.; second to William Wehagan, Atlas Foundry Co., and third to Louis Simeon, Hill Clutch Machine & Foundry Co. For steel casting first prize was won by Joseph Birkenheuer, Crucible Steel Casting Co.; second prize by Robert Darmour, Crucible Steel Casting Co., and third prize by Thomas Jameson, West Steel Casting Co. Nonferrous prize winners included: First prize, John Jesso, Wellman Bronze & Aluminum Co.; second prize, Peter Palshook, Gluntz Brass, and third prize, Louis Taus, Aluminum Co., of America. In the patternmaking contest first prize was won by William Theis, Warner & Swasey Co.; second by John Burezky, Master Pattern Co., and third prize by Albert Jazbinski, Cleveland Trade school.

In his address, Mr. Glass emphas-

(*Continued on page* 52)

# This is the *model* mold conveyor you admired at the show

## THE C. O. BARTLETT &

ENGINEERS, DESIGNERS AND FABRICATORS FOR THE FOUNDRY

# And this is how *real ones* perform in service

1. A 79 car, 316 ft. unit installed in a large pipe fittings foundry in 1924, and still in use today, handles the output of 22 molders producing 450 molds each per 8 hour day—also a second unit installed in 1926 in the malleable section of this same plant serves 32 molders—handles 13,500 molds per 8 hour day.

2. A 101 car 404 ft. unit installed in 1926, in another large pipe fittings foundry—but handling snap flasks—serves 30 molders, each making 400 molds per 8 hour day. Still giving excellent service after 14 years.

3. Four 53 car, 238 ft. units and eight 101 car, 464 ft. units in one large automobile plant—being used on a variety of work including cylinder blocks, cylinder heads, pistons, transmissions, fly wheels, and miscellaneous small work—handle upwards of 2300 tons of castings a day.

4. An 84 car 504 ft. unit installed in 1928 in another large automobile works handles loads of 4500 lbs. per car so satisfactorily that three additional units have been added since in other divisions of the same plant.

● Bartlett-Snow Mold Conveyors in gray iron, malleable and non-ferrous foundries are handling loads of from 300 to 5400 lbs. per car. They insure your getting a maximum of both quantity and quality from your plant with a minimum of space and flask equipment. We solicit your inquiries which will have our full and prompt attention.

T & SNOW COMPANY

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CHICAGO, ILL.

(*Continued from page* 49)
ized the necessity of close and intelligent control of all materials and operations. In recent years higher standards have been established and customers are more exacting in their demands for perfect castings. In many respects castings that would have been acceptable in former years would be rejected under present conditions. He outlined in detail 10 steps involved in the production of a casting and showed how control methods should apply to each one. While the primary object of management is to analyze conditions and see that the proper methods and equipment are available, a second function is to train employes in the necessity for and the application of improved and modern methods and control apparatus. He concluded with the presentation of a number of slides showing typical casting defects, description of the causes and the proper remedial methods to employ in their eradication.—*Pat Dwyer.*

## St. Louis

ANNUAL business meeting of the St. Louis District chapter was held on May 23 at the York hotel, St. Louis, with Chairman L. E. Everett presiding. Executive Secretary C. E. Hoyt spoke briefly giving greetings from the national office, and an encouraging word to all present. Winners in the local apprenticeship contest were announced as follows: Gray iron—first prize, August Blumenberg, Carondelet Foundry Co.; second, Lawrence Clouse, Carondelet Foundry Co., and third, Richard Blumenberg, Carondelet Foundry Co. Steel casting—first prize, Russell Mueller, St. Louis Steel Casting Co.; second, Bernard Teiper, St. Louis Steel Casting Co., and third, James Dimos, American Mangarese Steel Co. Pattern—first prize, Ray Twillmann, National Art Bronze Co.; second, Edward Elstermeyer, Arenson Pattern Co., and third, Glen Judkins, National Art Bronze Co. Winners were presented with cash awards given by the chapter.

Annual report of the secretary-treasurer was presented which outlined the year's activity and a statement of the current financial condition. Tom Hamlin, chairman of the nominating committee, presented its report recommending election of the following officers and directors: Chairman, W. Carter Bliss, Scullin Steel Co.; vice chairman, L. J. Desparois, Pickands, Mather & Co., and secretary-treasurer J. W. Kelin, Federated Metals division, American Smelting & Refining Co. Directors for 3 years, L. E. Everett, Key Co., East St. Louis; Walter Zeis, Midwest Foundry & Supply Co.; C. B. Shanley, Semi-Steel Casting Co., and George Mitsch, American Car & Foundry Co. They were elected unanimously.

Main speaker of the evening was Duncan P. Forbes, president, Gunite Foundries Corp., Rockford, Ill., who discussed, "Cost Plus Profit Equals Selling Price." The subject was one of universal interest and enjoyed by all present. Considerable interest was manifested in the round table discussion which followed Mr. Forbes' talk.

For the first time in years Jupiter Pluvius, did not attend the annual picnic of the St. Louis District Chapter of the A. F. A. The welcome absence of that universally unwanted guest helped to make the June 8 outing the best attended in years. Held at Joe Davies' Country club, Ferguson, Mo., the event was featured by real southern barbecue amplified by assorted good foods such as sausages, potato salad and all that goes with such toothsome delicacies. Ball games, horseshoe games, tennis, fishing and other favorite outdoor pastimes were enjoyed throughout the day by all in attendance. Prizes were distributed during the afternoon. The outing was a fitting climax to the fine work done by various members of the entertainment committee under the chairmanship of Charles E. Rochweiler.—*J. W. Kelin, secretary-treasurer.*

## Detroit

DETROIT chapter held its final business meeting of the season at Fort Shelby hotel May 16. Approximately 100 were present for the dinner, following which a short business session was held with Chairman H. W. Dietert presiding. The following officers were elected: Glenn Coley, Detroit Edison Co., chairman; V. A. Crosby, Climax Molybdenum Co., vice-chairman; W. W. Bowring, F. B. Stevens Co., treasurer, and A. H. Allen, THE FOUNDRY secretary.

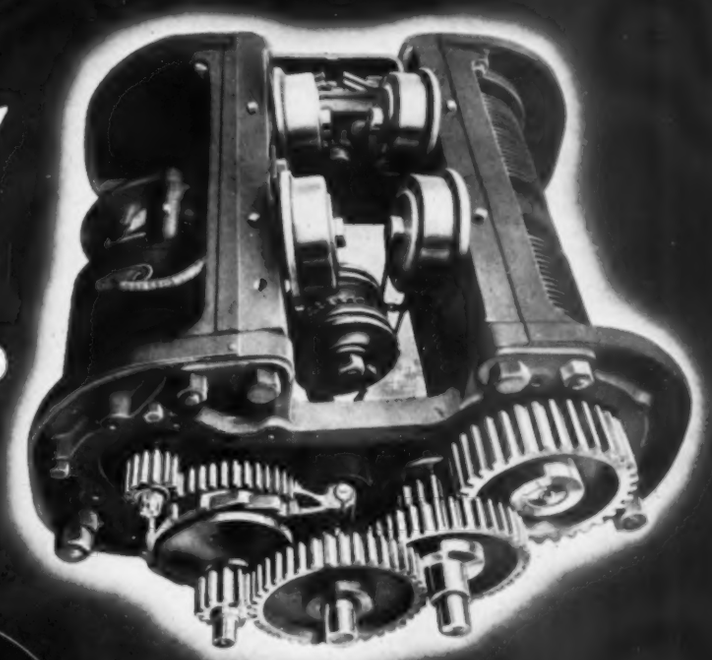
Directors for 3-year term: Earl L. Morrison, Budd Wheel Co.; Otto E. Goudy, Kelsey-Hayes Wheel Co.; Omer L. Allen, Pontiac Motor division, and H. W. Dietert, H. W. Dietert Co. For 2-year term: A. J. Gonter, Dodge division, Chrysler Corp.; R. G. McElwee, Vanadium Corp. of America; J. H. Crawley, and Howard McCoy, Cadillac Motor Car division. For 1-year term: R. B. Crawford, Atlas Foundry Co.; F. J. Walls, International Nickel Co.; A. L. Boegehold, General Motors Research Laboratories, and F. A. Melmoth, De-

(*Concluded on Page* 54)

Right—W. J. Cameron, Ford Motor Co., Dearborn, Mich. (center), principal speaker at a recent meeting of the Wisconsin chapter. W. J. MacNeill is at Mr. Cameron's right, and B. D. Claffey on his left

Left and right below—Other views taken during the meeting. Photos courtesy John Bing, A. P. Fire Brick Co., Milwaukee

# Better Buy the EASILY SERVICED HOIST



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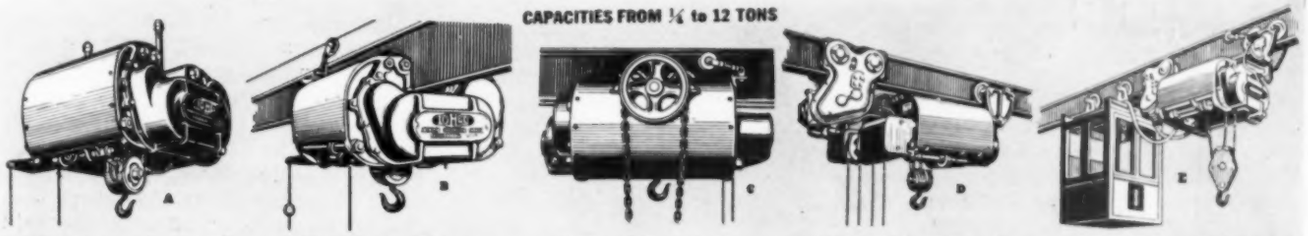

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(*Continued from page 52*)

troit Steel Casting Co., Detroit.

Guests at the meeting included Jack VanStone, General Motors Research and Jack Kress, Cadillac Motor Car division, each of whom was awarded a prize in the apprentice patternmaking contest, their patterns being on display at the Chicago foundry show. The presentation was made by Mr. Stettbacker of the Employers Association of Detroit.

Following the business session, a question-and-answer program was held, in which a committee of ten had been chosen to answer any and all foundry questions which might come from the floor, within an allotted time. This was the first meeting of its kind held in Detroit, and it proved to be educational, as well as entertaining.—*O. E. Goudy.*

## Pittsburgh

REGULAR May meeting of the Pittsburgh Foundrymen's association was held on May 20 at Clifford B. Connelly Vocational high school. This meeting was out of the ordinary because of the meeting place, which is of particular interest since it contains a complete foundry, outfitted largely by the association a number of years ago and devoted to training boys in this district in preparation for work in the foundry industry.

Before the dinner, which was served in the school cafeteria, the members and guests, numbering about 135, inspected the school's foundry and watched some of the students engaged in various stages of castings manufacture under the direction of H. W. Dosey, foundry instructor.

The regular meeting program was held in the school auditorium. Dr. L. H. Turner, principal of school, welcomed the foundrymen. Safety was the subject up for discussion, and I. A. Brinkman personnel and safety director, Mackintosh-Hemphill Co., delivered a paper on accident prevention, outlining the proper method of setting up a safety program including the allotment of responsibilities in their best places for most efficient results. Mr. Brinkman, spent considerable time outlining the changes in Pennsylvania's industrial compensation act. He also showed a slide-film prepared by the National Safety council, entitled "Grime Does Not Pay."

Chief discussion at this meeting centered around the work of Connelly trade school in the foundry field. Mr. Dosey appealed to the members of the association for co-operation in placing the handful of boys graduating from the foundry course each year, and the members decided to form a placement committee which will find jobs for every boy, insofar as possible.

Under the direction of J. M. Stewart and his committee, one of the most successful outings of recent years was held at South Hills Country club. In point of attendance, it was the largest in the history of the Association with 337 men, beating the previous high by some 25 persons.

Golfers began their day early in the morning, with most of the crowd gathering late in the afternoon, when the foundrymen went down to inglorious defeat before the blitzkrieg attack of the supply men, 6 to 1. K. R. H. Nelson, Ferdinand G. Schultz Co., managed to get his "nothing-ball" past the foundrymen easily, while the salesmen made short work of the slants offered by C. J. Scheckhaus, twirler for the foundrymen.

After a buffet supper, prizes were awarded by J. M. Stewart, Hickman-Williams Co., and chairman of the affair, aided by W. S. Scott, Pittsburgh Coke & Iron Co. In the golf line-up, J. E. Lawry, Steel Products Co., last year's winner, repeated with a 72. W. S. Scott was second with 77, while D. A. McGraw, Wieman & Ward Co., and C. P. Sidwell, Sidwell Loam Sand Co., were tied for third with 78.

High gross was taken by W. C. Samuels, F. Obermayer Co., with 133, while in the special awards, L. L. Brown, Mackintosh-Hemphill Co., had the longest drive off No. 1 tee; and F. W. Bruce, Carnegie-Illinois Steel Corp., was highest on No. 18.—*R. L. Hartford.*

## Northern Iowa

OVER 300 attended the April meeting of the Northern Iowa Foundrymen's association held April 29 at Waterloo, Iowa, in conjunction with the annual Foremen's dinner and safety meeting sponsored by the John Deere Tractor Co. In addition to members of the association and foremen of the Deere company, guests were present from Rath Packing Co., Galloway's, Litchfield's *Waterloo Daily Courier*, W. C. F. & N. railway, Illinois Central railroad, Construction Machinery Co., and other firms in the locality.

Capt. A. A. Nichoson

Speaker of the evening was Captain A. A. Nichoson, personnel director, Texas Co., who presented an inspiring talk on "Safety—An Effective Lever for Better Understanding." Captain Nichoson was introduced by Herbert W. Rehder, personnel director, John Deere Tractor Co., and pointed out that many of the present-day difficulties in industry have been due to misunderstandings, and an effective program of safety and security will do much to solve those problems—*R. E. Wilke, secretary.*

## Ontario

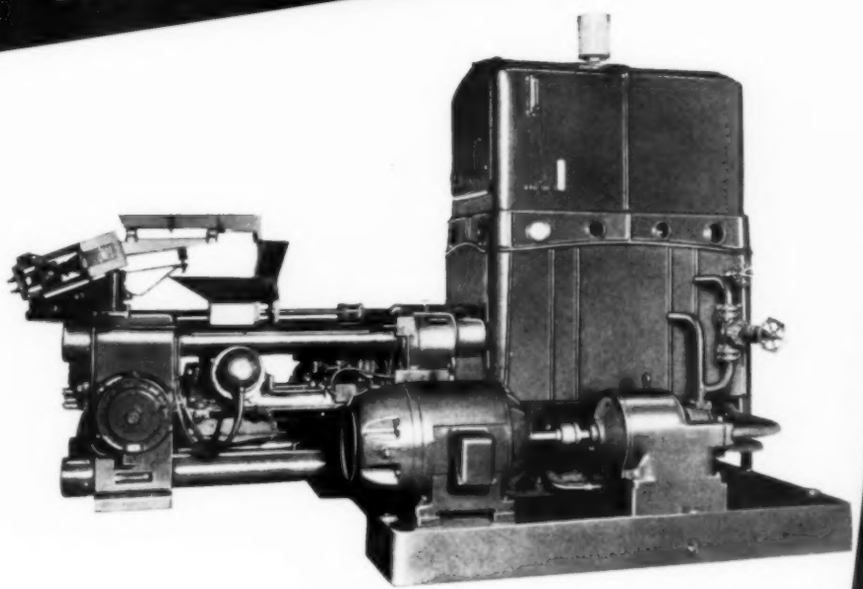
ANNUAL meeting of the Ontario chapter was held May 31 at the Royal York hotel, Toronto, with D. J. Macdonald, Dominion Radiator & Boiler Co., Toronto in the chair. Later, the new chairman, D. J. Storie, fittings, Ltd., Oshawa, Ont., took over the duties of office. Mr. Storie introduced N. B. Clarke, Steel Co. of Canada Ltd., Hamilton, Ont., the new vice chairman. S. R. Francis, Metals & Alloys Ltd., Toronto, will continue as secretary.

In a short address Mr. Macdonald pointed out that the rapidly increasing tempo of certain war industries might create a need for expanded inspection facilities which could possibly be supplied in part through the utilization of trained men available in the foundry industry. The matter was to be taken up with Ottawa, and it was believed that all members would be anxious to cooperate in any way possible. In taking over the chair, D. J. Storie, spoke of the fine work of D. J. Macdonald and of two retiring directors.

Reviewing the highlights in gray iron at the A. F. A. convention, Chicago, J. C. Stavert, metallurgist, Babcock-Wilcox & Goldie-McCulloch, Ltd., felt that great progress was being made in broadening the field of research and finding the fundamental reasons for metal properties. Metals, sands and cupolas are all objects of more intensive research. Mr. Stavert reviewed a number of papers particularly stressing work being done on the influence of the mold upon castings especially in regard to shrinkage defects. The profound effect of very small percentages of some of the rarer elements upon the properties of irons is also of the highest import.

(*Concluded on page 62*)

# *Announcing* A New Line of SMALLER Milwaukee Briquetting Presses



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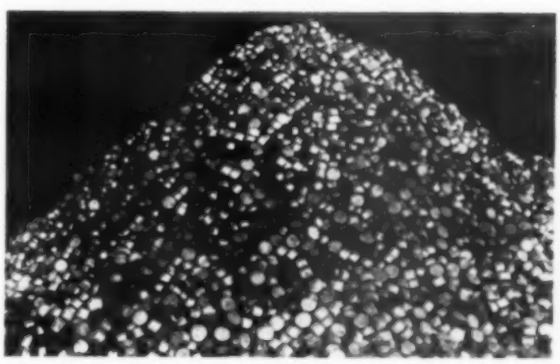

*Cast iron briquettes from a Milwaukee Hydraulic Briquetting Press. Handled with magnet to material yard, ready for remelting in the cupola. Note uniformity.*

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# THE ADVENTURES OF BILL

By PAT DWYER

Drawings By RICHEY

EVER since we came back from Chicago," Bill said the other night, "I have intended to ask you for a ray or two of light on a big brass plaque fastened to the wall of one of the picture gallery dining rooms out there at the stock yard. This plaque is about 3 feet long, and off hand I should say about 16 or 17 inches wide. It is a little thicker than similar castings made in recent years, say about ½-inch, but I should say at a guess that it could be poured nicely from a No. 50 pot."

"If you know so much about this object," I pointed out calmly and logically, "why should you come to me for a spot light, head light, flash light or any other kind of light?"

"Ray of light, dear friend, was the term in which I couched my modest request. Perfectly immaterial to me where you get it, spot light, head light, flash light, day light, moon light or the late Mr. Grey's light of western stars. In the present instance and basing my opinion on your preliminary squirming, jouking and dodging I am afraid I am up against the light that failed. If I had a dictionary I could figure the thing out for myself."

"Figure what out? Dash it all, man, I am no mind reader. What's this about a dictionary? I thought you had one."

"Had is right. A fine handsome volume I won at a raffle one time, 2 bits per ticket and free beer. After several years service as a door stop and window holder upper it became kind of dingy and run down at the heels. Over a period of years my uncle Malachi has nipped out nearly all the leaves for pipe lights. Claims these here now modern safety matches in paper holders are too limber and besides they nearly always either burn his fingers or the whole mess catches fire and threatens to burn the house down. 'Give me a good paper spill,' he says, 'folded properly mind you in true workmanlike manner straight and even, an' ye can t'row all thim little blazin' invintions iv the divil back to the owld b'y himself with the split hoofs, the short horns and the long tail with a poison tip onto the free and wavy ind iv it. Matches, indeed!'

"With the familiar but thoroughly unjustified excuse that he wanted to see how it all came out, he began at the back of the book among the *Zs*, the *Ys* and the *Xs* and gradually worked his way like a grazing cow toward the beginning. The last time I picked up the book—I wanted a weight to hold down the corner of a rolled blue print—the deflated wreck looked like what is left of a casting after the metal has burst through the bottom board. Just a shell."

"All highly interesting," I admitted politely, "but it seems to me you have wandered a long way from the plaque. I hope," and here I gave him the eye, "I hope you did not lift it to bring home among your souvenirs."

"Why should I bring it home?"

"For your uncle Malachi to rub his back against. Any man who tears a good book to make pipe lights probably is a back scratcher, a tooth picker, a nail biter, a snuffler who ostentatiously uses a napkin to polish every spoon, fork and knife before he eats."

Can't stop him by turning a knob

"There," said Bill, "is where you fall into grievous error and do the old boy a grave injustice. He does not pick his teeth for the very good and sufficient reason that he has no teeth. One of the best gummers in this or any other country including the Scandinavian. He does not fall into the social error of polishing the eating tools. Do you know why? Because in his innocence and ignorance he assumes the tools are clean. Secondly, if I may be pardoned for adopting the formal manner of presentation, I doubt if he ever saw a napkin. And thirdly, he ate so many meals out of a tin can while sitting on a bottom board with his back up against the core oven door that he not only does not miss the napkin, but could get along without any other tools than his eight good fingers and two thumbs. You should see him gnaw a hunk of tough steak or snap at a slice of dry toast! Positive pleasure I assure you to watch him shoveling the grub into his maw with both hands. The double hand technique of course was developed in the old days when every molder cut over his own sand and was not allowed to put down the first rollover board before 8 o'clock. I mind one time while the old Fulton shop was still down on the flats in Cleveland—"

"I know," I said, "Charlie Dickson was the boss and old Alex Faulkner was financial secretary, autocrat and dictator in 218. Old stuff, water over the dam, or under London Bridge and all that kind of thing. Bury them all in the back of the sand pile with your other wasters and get back to the plaque. Some time back, if my memory is in good working order, and my impression is that it is in excellent working order, you placed a plaque on the agenda. You have heard the motion. Are you ready for the question? What disposition do you want made of it?"

"Oh, yes. The plaque, the plaque, the good old bronze plaque, lettered

(*Continued on page* 59)

(*Continued from page* 56)

in front and plain on the back. Eulogizing the stockman in terms so high, in the past, in the present, in the sweet bye and bye. He's a darb, he's a dandy, Old Nick with the pack, a combination of four aces, the king, queen and jack!'"

"Is that the inscription on the plaque?"

"No. That is what you might call a kind of mild poetic reaction to the noble inscription. Comes natural to a lineal descendant of Hughie the Harper, bard and so forth to Brian Boru at his castle on Tara hill. Have you ever heard about the harp that once through Tara's halls and all that kind of stuff? Well, he was the first harper in the family. With a few noggins of mountain dew inside him he could twang the harp and reel off poetry like a modern mill rolling sheets. 'Tisn't often I feel the urge, but the lofty and melodious inscription on the plaque touched off a hidden spark and resulted in the foregoing—ah—modest little contribution."

"Like the hotel clerk in a certain famous story that never has been printed, but with which you undoubtedly are familiar, I give up. You begin with a brass plaque nailed to the dining room wall, stick in a piece of wretched doggerel, and end up with a boastful reference to an old harper ancestor who probably had a long beard, no teeth, a perpetual drop on the end of a long, pointed nose and a pair of cock eyes affectionately leaning toward each other. Now you want a ray of light! What you really want is a cane and a tin cup, a pair of colored glasses and a nice little shivery dog with a cough to lead you around. You're lost."

"Well," said Bill, "I'll tell you. This here now plaque attracted my attention, not because of the inscription, a most remarkable composition, but on account of the location. In my ignorance I always had assumed that the Chicago stockyards was a place where thousands of animals were given the works every day and converted into food for the human race. In the old heraldic manner the shield would show a field *rouge* with a bloody hand gripping a cleaver and with a motto *We Bop 'em Off*. Instead of that I found a plaque with a tribute all sweetness and light eulogizing the master stockman. I thought the master stockman was the head man or chief bopper, but to my astonishment learned that he was nature's greatest benefactor, the man who raised the crop for the bopper. Pon my word I should not have been more surprised if I had walked into Bluebeard's secret chamber and found Snow White playing with her dolls while her faithful little short leg henchmen swept down the cobwebs, polished the furniture and pushed the sweepings down a rat hole. I read the inscription over twice to make sure my eyes were not playing tricks. Then with the gracious permission of the large and friendly colored head waiter I made a true and faithful copy. The tribute is headed The Master Stockman. Listen:

With glad acclaim and bearing garlands bright and wreaths of bay, we sing the glories of the fecund fields where herdsmen-shepherds hold their gentle sway! In pastures green by running brooks, in bosky dells, in grassy nooks, the distant mellow jangling of sweet bells proclaims the peaceful paths of lowing herds and fleecy flocks, the gifts supreme of husbandry. Blessed be the lands on which they graze! And blessed those who guide them on their ways! Wielders of power that verges on the infinite itself! Dreamers of dreams who live to see their dreams come true! Workers of miracles in a world that's all their own! Keepers of keys to life's most hidden mysteries! Let Kings and Lords of lesser human realms make way! While all the nations from the depths of grateful hearts unite to crown the Master Stockman, master of the art of arts!'"

"Have you ever seen anything to equal that?"

"No," I admitted, "I doubt if the late Mr. Milton in his loftiest moments could touch it. Sounds to me like something your harpy great uncle might have chanted after he lifted his face out of a tub of potheen and wrung out his beard. According to popular tradition stock raising was practiced extensively by the ancient clans. Biased historians always referred to the practice as stock raiding, but charitably we may assume that is a typographical error. The old boys were notoriously poor spellers. Down to this day members of the same clan spell their names in half a dozen different ways."

"I wouldn't know about the spelling," Bill said, "I never was any good at it, but in the field of general knowledge, the average citizen would not collect many medals. Ask any given number of people where the Norfolk navy yard is located and four out of five will say Norfolk, Va. You know of course and I know the yard is in Portsmouth—"

"You can stop right there," I said, "I can see no good or sufficient reason for dragging the United States navy into the argument. Unless," I added as an after thought, "unless you are proposing to land a company of marines. These leathernecks have built up a bit of a reputation as argument settlers big and little. Come to think of it, the celebrated horse marines would be just the boys to give you a straight tip

(*Concluded on page* 104)

**Enthusiastic steel casting inspectors constantly are inventing new and improved methods of conducting daily tests**

# DETROIT AMONG FOUNDRIES

By A. H. ALLEN
Detroit Editor, The Foundry

THE industrial metropolis of Detroit is counted on to play a major part in the huge defense program now being engineered at Washington. While it is still too early to know definitely just what must be done, who is going to do it and how soon it must be done, it seems a foregone conclusion a large share of the industrial capacity in the Michigan area will be called upon to participate in armament and defense equipment manufacture—motor trucks, airplane parts, airplane engines, shells, machine guns, gun carriages and a host of other war materiel. Obviously a vast amount of castings will be required.

### Machine Tools Needed

Allocation of this work is one of the most difficult tasks confronting William S. Knudsen and his staff in Washington, which now has complete charge of the manufacturing phase of the program. Machine tools and airplane engines seem to be the two major bottlenecks to be eliminated; both call for castings, the former iron and steel, the latter principally aluminum and magnesium.

In alleviating shortages of machine tools, Detroit foundries perhaps will be asked to reschedule production so that castings requirements for machinery will get first call. Plants unfamiliar with that type of work may be pressed into service to supplement existing sources of such castings. Establishment of priorities on machine tools likely will place all parts going into their construction in the *AAA* class, necessitating sidetracking of other material.

Steps have been taken to open the way for increased quantities of nonferrous castings. Aluminum Co. of America foundry at Detroit, operating 34 noncrucible furnaces melting aluminum alloys for sand and permanent mold aluminum castings, has been adding to its working force with all possible speed. About 800 men are busy on the day shift and efforts are being made to bring a second shift up to this level. It is reported that if the men could be located a third shift would be added, but it is virtually impossible to find suitable personnel. While it is possible to "make foundrymen out of shoemakers," as the Aluminum company actually has done in certain instances, the conversion takes time and meanwhile production suffers.

The Aluminum company's magnesium division, American Magnesium Corp., Cleveland, hard pressed to fill orders from the large aircraft engine builders, Pratt & Whitney, Curtiss-Wright, Allison, etc., has taken steps to relieve some of this congestion by re-equipping an old plant on Elmwood avenue, Buffalo, for the production of magnesium castings, principally for the Curtiss-Wright company in Buffalo. This plant has been idle since 1932. About $400,000 has been spent for molding, coremaking melting and handling equipment to permit resumption of operations by July 1 if possible.

### Produce More Magnesium

Harry P. Deutsch, superintendent of the Detroit plant of Aluminum company, was slated to head the new Buffalo operations, but the untimely death of John W. Collins, manager of the Detroit plant, may necessitate a change in these arrangements. Mr. Deutsch has been in Buffalo supervising the hiring of a working force and installation of equipment.

Magnesium Fabricators Inc., Adrian, Mich., a subsidiary of Bohn Aluminum & Brass Corp., is loaded to the gunwales with magnesium casting business and has built several additions to its plant since operations were reviewed in THE FOUNDRY a year ago.

Intense pressure on the magnesium castings industry naturally transfers an equal load on the source of magnesium metal. The Dow Chemical Co., Midland, Mich. making every effort to cope with the heightened demand, is building a new reduction plant at Freeport, Texas, reportedly for production of bromine and magnesium, as a second source to supplement present facilities for production of the two.

Dow Chemical also has announced construction of a new foundry 80 x 200 feet, steel frame at Bay City, Mich., to cost $100,000, to be completed around Aug. 1, and to employ 200 men. Magnesium castings will be the principal output. Present foundry, fabrication shop and laboratory, employ about 250.

Another important phase of the defense program will be armor plate, for tanks, ships, armored cars and other mobile equipment. Cast and rolled armor plate have been used in years past and while only a handful of steel foundries are on the government's approved list for this material, it is likely a good many more are being added as sources of supply at the moment.

Cast steel armor usually is a nickel-chrome-molybdenum steel, with high carbon, in thicknesses around ½ inch. Oil quenching gives hardness in the neighborhood of 600 brinell. Steel foundries using conventional equipment for melting and casting this material, may require additional heat treating facilities for proper conditioning of the plate after casting. Cast plate is used in tank gun turrets and other places where the desired contours can be obtained most easily with a casting.

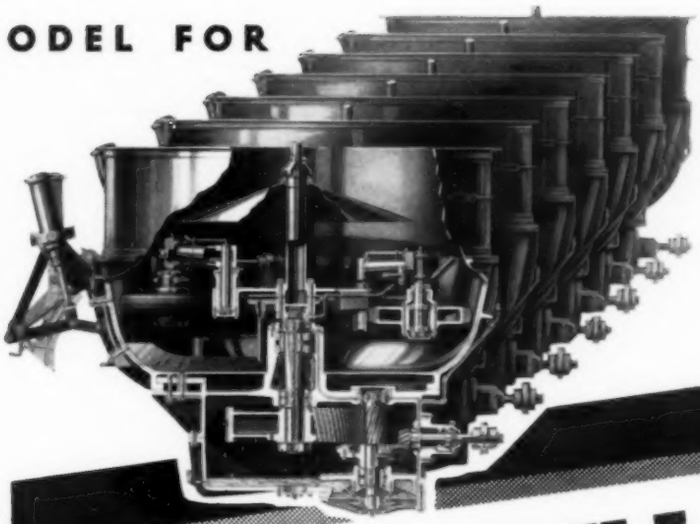
### Carburize Armor Plate

Rolled steel armor plate, of course, is used extensively in battleships, some thicknesses ranging up as high as 12 to 14 inches. One variety is carburized on one side only to provide extra resistance to impact on the outer side. The backing is a more ductile steel.

All armor plate must meet rigid government specifications and must pass certain minimum ballistics tests. Rejection in past years always has been high because of the exacting specifications. It is felt in many quarters that a thorough review of these specifications by metallurgical experts might result in sufficient relaxation of limits to greatly facilitate production without undue sacrifice in properties.

(*Concluded on page* 62)

A MODEL FOR EVERY NEED



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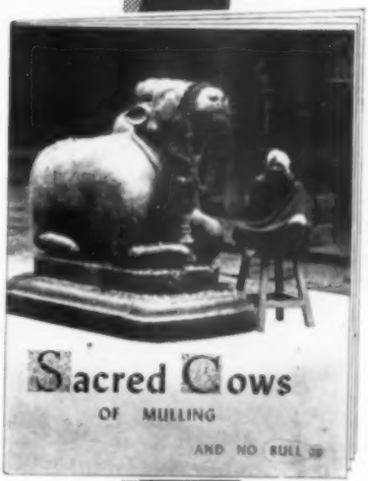


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## THE BEARDSLEY & PIPER COMPANY

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(*Concluded from page* 60)

Steel castings likely will find extensive application in heavy caliber shells. One Michigan company already has launched an intensive development program leading to the start of shell manufacture by a new process.

Interesting example of the effectiveness of *processing* cupola iron to produce certain desired effects in castings is seen in recent activity by one of the large automotive foundries in Detroit which was experiencing difficulty with dendritic structures and resultant objectionable hardness in cylinder blocks, particularly those in which a high percentage of steel was added to the cupola charge.

These blocks showed an average silicon content of 2.20 per cent. A metallurgist with one of the local alloy suppliers recommended reducing the silicon content in the cupola iron to 1.70 per cent, then raising the silicon content 20 points by adding ferrosilicon to each ladle. Blocks poured from the treated iron showed no dendrites and machined even better than the former blocks.

**Raise Silicon in Ladle**

Later, when porosity developed in a few blocks, the silicon in the cupola charge was reduced to 1.50 per cent and raised 20 points in the ladle. Apparently the treatment has resulted in complete elimination of previous difficulties. It is estimated that silicon added to ladle iron has three times the effectiveness of silicon in the cupola. This processing of cast iron is heralded as a distinct innovation and perhaps indicative of future progress.

Wilson Foundry & Machine Co., Pontiac, Mich., has disposed of six outlying buildings to Yellow Truck & Coach division of General Motors, which will use them for storage purposes, necessitated by the pressure of government truck orders. One of the buildings housed the Wilson machine shop which has been moved to another location in the consolidation of operations. The Wilson foundry is active, supplying castings to Willys and Reo Motors in Lansing. The latter account should be strengthened by military truck orders.

Owosso, Mich., plant of the defunct American Malleable Co., once representing an investment of about $1,000,000 has been sold to Mid-West Abrasives Co., Detroit for $10,000. Remodeling is under way and Mid-West will occupy the premises about Aug. 1. A force of about 100 will be employed at first and later the Mid-West abrasive plant Rochester, Pa., will be transferred to Owosso.

Delay of about one month on the Pontiac foundry building program, reviewed in this department last month, has been encountered, reportedly because of continued strength in new car sales. Work on the new buildings and installation of equipment now is scheduled for completion July 1.

## Foundry Group Activities

(*Concluded from page* 54)

Covering malleable iron at the convention, J. J. McFadyen, Galt Malleable Iron Co., Ltd., Galt, Ont., said that the relative scarcity of outstanding investigation in the field might be attributed to the fact that chemical control had to be introduced at an early stage in malleable iron manufacture, while the gray iron industry had entered more recently its great research program. Conclusion drawn from the malleable round table conference was that Canadian plants compared favorably in their practice with those in the United States.

A nonferrous program which, was characterized as well organized, was reported by Joseph Sully. Papers of interest included those on melting procedures and one presenting a rather revolutionary method of top-pouring bronze. At the round table conference subjects of importance were the use of degasifiers, covers, etc., the effectiveness of certain very small additions in improving the aluminum bronzes and the substitution of silicon bronze for tin bronzes under the influence of higher tin prices.

The field of scientific instruments was reviewed by O. W. Ellis, Ontario Research foundation.

Some fine entertainment arranged for by entertainment committee chairman, C. C. MacDonald, Frederic B. Stevens, Canada, Ltd., Toronto, rounded out an excellent program.—*Joseph Sully, director.*

## Youth Training

Cleveland Personnel Managers association, in co-operation with the National Youth administration has sent out questionnaires to employers of 70,000 workers requesting information on present and future employment needs with the view of training young men between the ages of 18 and 25 to meet the demands. Present plans are short, specialized training courses of 4 hours a day, 5 days a week, for 4 weeks, and which pays the youth being trained $18.

A training center has been obtained and equipment is being installed. In addition it is planned to use the industrial training facilities of Cleveland public schools. The association, acting in an advisory capacity, will suggest types of equipment to be installed, curriculum, length of training schedules, methods of selection of applicants, and qualifications of instructors. Candidates for the specialized training will be selected jointly by the NYA and industrial firms in the market for youths with training. George J. Leroux, National Malleable & Steel Castings Co., Cleveland, has been designated by the Personnel Managers association to head up the foundry division.

## Discusses Sand

F. E. Schundler & Co., Joliet, Ill., and the Midwest Foundry Supply Co., Edwardsville, Ill., recently sponsored a meeting of approximately 20 foundrymen of the St. Louis area at which Charles Schureman, technical counselor of that organization presented an interesting and instructive discussion on synthetic sands and the use of bentonite in the preparation of such sands.

## Organize to Reduce Sick Absenteeism

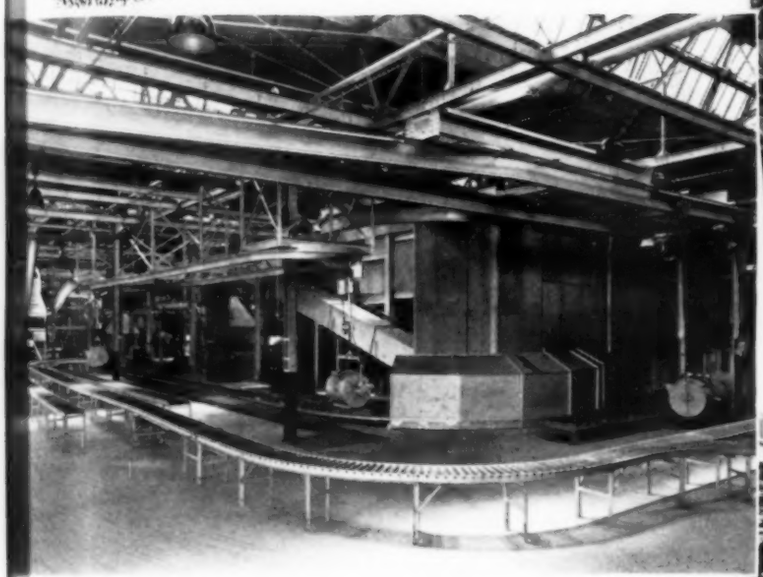
An organized effort to reduce sick absenteeism throughout the heavy industries is being launched by Air Hygiene foundation, Mellon institute, Pittsburgh, a national organization of manufacturing and mining concerns for the advancement of industrial hygiene.

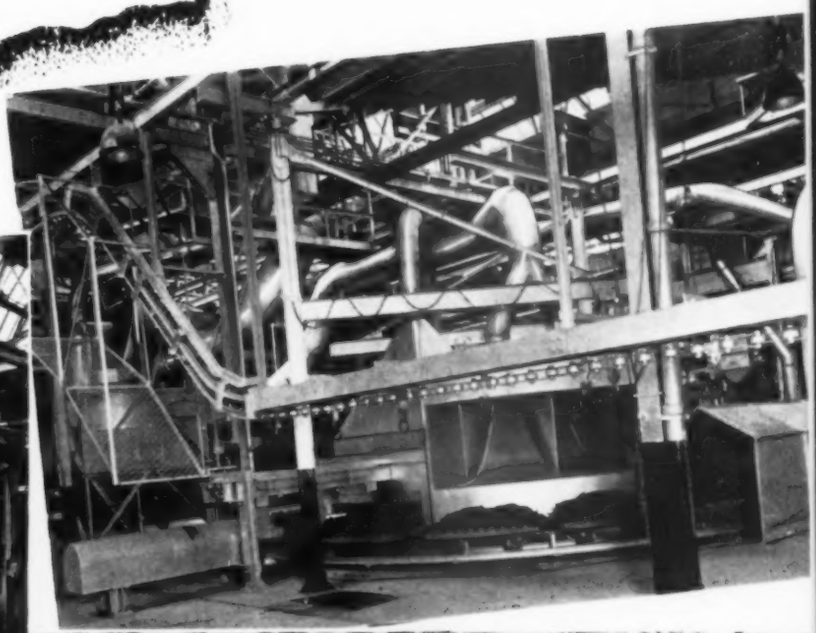
A preliminary report, "Sick Absenteeism in Industry," has just been released to the 200 member companies as the first step in the undertaking. There are three steps in the program. First, preliminary report which attempts to picture the problem for management. Second, keeping of records on sick absenteeism by the participating companies on prescribed forms. Third, analysis of these records which will be held strictly confidential. This analysis is expected to yield specific ways and means whereby the participating companies can cut down their number of lost workdays through sick absences. Co-operating with the foundation in the study are the U. S. public health service and the American Association of Industrial Physicians and Surgeons.

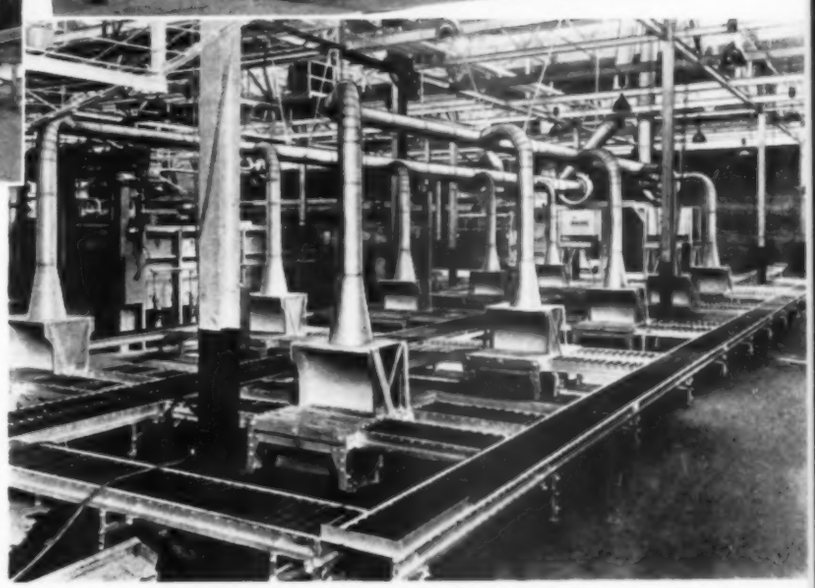
American Society for Testing Materials, 260 South Broad street, Philadelphia, recently has issued its *Index to A.S.T.M. Standards, Including Tentative Standards*, which gives information on all of the 885 standards as of Jan. 1, 1940.

# 49 ROTO-CLONES IN ONE SINGLE PLANT

## Collecting Dust in the Foundry, Casting-Cleaning room and Machine Shops







*Photos Courtesy International Harvester Company, Truck Engine Works, Indianapolis, Indiana.*

● Adequate dust control plays an important part in any production program designed to take care of increased demands. Roto-Clone Dust Control systems engineered by the American Air Filter Company are now in use in a great majority of America's leading foundries. Our engineering department is available without obligation to study your dust problem and recommend a satisfactory and economical solution.

Information on the use of the Roto-Clone for Foundry dust control will be sent without obligation. Of special interest is the new Roto-Clone picture book containing 79 photographs of typical Roto-Clone installations. Write today to Department 713.

● The application of the Roto-Clone to all types of foundry dust control is graphically illustrated by the accompanying pictures made in a large mid-western foundry where all dust problems are effectively handled by means of Roto-Clones. Type D (Dry type) units are used for collecting grinding and metal working dusts. Note exhaust hoods for chipping operations in the casting cleaning room where two No. 20 Type D Roto-Clones collect the fine floating particles. Dust in the Foundry proper is controlled by Type W (Wet) Roto-Clones, several of which can be seen in the above illustrations.

ROTO-CLONE
DUST CONTROL

AMERICAN AIR FILTER CO., INC.
INCORPORATED
LOUISVILLE, KY.

# CONVENTION REVIEWS PROGRESS

(*Continued from page* 35)

day afternoon of convention week and directed by James R. Allan, International Harvester Co., Chicago. Mr. Rentschler stated that foundry management has a selling job to do in starting and maintaining such a program. All individuals connected with the foundry must be convinced that safety is for their individual benefit as well as for the firm.

With the aid of numerous slides Mr. Rentschler explained the work done in his plant relative to safety practices, and pointed out that good housekeeping is one of the most important phases. Part of the program consists in maintaining permanent displays of safety devices, unsafe tools picked up any time in the shop, and in regular meetings and inspection by workmen and foreman committees, meetings of employes, etc. The safety program has resulted in the development of health consciousness by the employe for both himself and family, interest in health lectures, safety consciousness, and greater use of first aid in the plant. Mr. Rentschler said that the safety program was established and is operated without any increase in personnel, and that interest is maintained continually by use of lectures, distribution of literature on the subject, and by dramatization of any phase connected with the work.

Roger Bronson, Chicago, spoke on workmen's compensation and occupational disease insurance. He stated that pure silicosis, when not complicated by tuberculosis, is not disabling in the foundry, but the possibility of tuberculosis complication does exist so the foundry must be on guard at all times. He said it was advisable to make available to the men involved, x-ray information where tuberculosis is indicated so that proper measures may be taken to restore health. Cost of insurance is reduced by establishment and maintenance of safety practices and in this good housekeeping is very important. The foundryman always should keep in mind the fact that men establishing insurance rates are laymen as far as the foundry is concerned, and act accordingly.

### Reduce Dust Conditions

Even though safety and hygiene have made considerable strides in the foundry field over the past few years, there still exists a great possibility of improving conditions. In the discussion which followed Dr. Kronenberg, Illinois Industrial commission, said he rated good housekeeping as 65 to 70 per cent of a safety and hygiene program. Warren Cook said that it was a revelation to many that a foundry could be kept clean, and that safety and hygiene could be developed to such a high efficiency. He also stressed the fact that while the silicotic may not be disabled, there was the possibility of tuberculosis complication, and therefore, it was advisable to reduce dust conditions to the lowest possible point.

Foundry cost session held Wednesday afternoon was well attended. Chairman R. L. Lee, Liberty Foundry Inc., Wauwatosa, Wis., also chairman of the foundry cost committee of the A.F.A., presented for discussion the committee's report on cost classification of the melting, molding and core departments of the gray iron, malleable, steel, and nonferrous branches. The report lists in parallel columns various similar items from different branches and their distribution as to direct or indirect labor costs.

Discussions centered around variations in the allocations as tabulated to obtain the consensus on whether they are correct or need changing. For example there was some difference in opinion on distributing pouring cost for gray iron to direct labor in the case of molders doing that work, or to indirect cost with a separate pouring crew. Opinion indicated it should all be direct labor in order that the cost can be applied to the specific casting. It was pointed out that in the case of molders working on a day rate, it was easy to make a cut-off from molding to pouring, and then make the latter an indirect charge. However, when piecework molding is employed, more difficulty is encountered in making the proper distinction.

Methods of charging for flasks were discussed, and it was decided that wooden flasks, considered as temporary, should be charged monthly; metal flasks should be charged to capital, and special flasks should be charged against the specific job on which they are used. It also was agreed that cost of pattern mounting should be charged definitely to the customer instead of the variable practice of charging in some cases and not in others. One speaker stated that his firm makes a practice of a $10 charge in each case. Others suggested use of alternate pricing when sub-

(*Continued on page* 67)

Close attention was given to the numerous exhibits. Photos by Sterling Farmer, Sand Products Corp., Cleveland

(*Concluded from page* 64)
mitting bids which designated differential prices for loose and mounted patterns, and for varying quantities of castings.

In closing Mr. Lee stated that the next work of the committee will be on the cleaning department. He pointed out the difficulties involved in that the malleable shop had 6 classifications, the steel foundry 2, and the gray iron foundry only one. Suggestion was made that the gray iron be broken down into several classifications instead of the present single one.

# APPRENTICE TRAINING

## Essential To Progress

REVIEWING historical details of apprentice training from the time of the craft guilds in the fourteenth century and tracing the changes through the years, A. L. Armantrout, South Works, Carnegie-Illinois Steel Corp., Chicago, examined the details of an adaptable apprentice program in the light of today's needs at the apprentice training session on Tuesday morning.

Careful consideration of a training program, close adherence to the original plan, formation of a supervisory apprentice committee working in co-operation with the management and with foremen, development of an accurate and complete system of records of apprentices' progress and careful selection of instructors for apprentices are some of the essentials of any intelligent program.

Mr. Armantrout observed that apprentice instruction outside the shop can make or break the complete training program and he advised close attention to provision of textbooks and instruction sheets. In routing apprentices through various phases of the shop, he said the best plan was to follow raw material through the plant from the receiving dock to the finished product.

He pointed out that small plants not able to afford a complete apprentice training program can combine with other plants in this work, and can obtain federal funds under the Smith-Hughes act for carrying out the training.

Wage rates for apprentices should be proportional to their ability to do productive work. At the South Works, they are started at 55 per cent of the going journeymen's wage and are advanced by 5-point steps until 90 per cent of the journeymen's rate is reached. Then apprentices are given an examination which, if passed, entitles them to the full rate.

Careful selection of apprentices is vital. First choice usually is confined to sons of employes, providing they can pass routine physical and mental ability tests. Mechanical aptitude ranks equally high with mental ability in rating apprentices.

"Training of foundry apprentices is the kind of education that will perpetuate the foundry industry on a high competitive level, the kind of education that will pay big dividends to the foundries which sponsor it, and the kind of education that will give our economic society many happy, useful and purposeful citizens," said A. H. Wornom, instructor of foundry training, Newport News Shipbuilding & Drydock Co., Newport News, Va., in a resume of the technique of training foundry apprentices. His company has had a training system ever since it was organized in 1888, the essence of it consisting of the well-known three H's—the hand, the head and the heart.

### Use Head, Hand and Heart

By the term "hand" is meant physical movements of all parts of the body necessary for doing a job. The term "head" covers the student's mental ability and the training he receives in classrooms and shops. The "heart" phase, equally if not more important than the first two, deals with the young man's enthusiasm and willingness to work.

The Newport News training program is built around Richards' formula which states that effective training (E) is the result of the proper combination of the five requirements of a good mechanic—manipulative skill (M), technical knowledge (T), auxiliary information (I), trade judgment (J) and

Plant visitations and the foundry show were features of convention week. Photos by Edwin Bremer

craft morale (Mo). These elements do not carry equal weight and in the final formula are arranged as follows:

$$E = 4M + T + 2I + J + 2Mo$$

Inasmuch as each apprentice represents a considerable financial investment, great care is exercised in selecting candidates, Mr. Wornom noted. Consideration is given to age, physique, scholarship, family background, residence and initiative as evidence by past accomplishments. Every apprentice is expected to keep himself physically fit and mentally alert at all times.

An interesting slant on apprentice training was presented by a graduate apprentice, C. W. Wade, Caterpillar Tractor Co., Peoria, Ill., who as explained by chairman C. J. Freund, University of Detroit, Detroit, was selected to give a first-hand critical review of his own training program in foundry practice.

Mr. Wade, in company with 11 other boys, began a 3-year apprentice program in foundry work in 1934. No full-time instructors were provided at that time to supervise the training program which was left largely to plant foremen. This did not work out so well, as the foremen did not place the boys on enough different jobs to acquaint them fully with plant operations. Hence, the system was changed to a 4-year course in 1935 and a full-time instructor hired who corrected defects in the old system and developed new technique.

The plant now has 24 indentured apprentices in the foundry, receiving individual instruction in both classroom and shop. Three supervisory men are provided, working in co-operation with foremen. The young men spend time in each division of the foundry, according to the production sequence

# Experts See Need OF FOREMAN TRAINING

FOREMAN training was the subject for a lively and profitable meeting conducted as a roundtable with a panel of experts leading discussion and answering questions. The audience participated freely in the program, with the result that much helpful advice and information was brought into the open.

Heading the panel and directing it with an experienced hand was A. D. Lynch, industrial relations manager, J. I. Case Co., Racine, Wis., who had directed similar efforts for the past 3 years. Assisting him as members of the panel were: W. E. George, assistant to management, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.; George J. Leroux, assistant manager, National Malleable & Steel Castings Co., Cleveland; W. G. Conner Jr., malleable foundry superintendent, Walworth Co., Greensburg, Pa.; E. A. Bacon, president, Smith Steel Foundry Co., Milwaukee; F. E. Bair, general superintendent, Ohio Brass Co., Mansfield, O.; and A. C. Ziebell, president, Universal Foundry Co., Oshkosh, Wis.

A number of questions were formally submitted, these falling under the general headings: "Why should we train foremen?", "Who should we train?", "How should we train them?", etc. A subject which received thorough going over was whether a foreman should be selected from within or outside an organization. The matter was brought up by a man associated with a small foundry whose personnel was not productive of foreman timber.

### Promotions Spur Morale

Consensus was almost unanimous that the selection should be made from within, since promotions spur up morale. In plants which are large enough, a program of pre-training should be carried on so that men of proper qualifications are ready for advancement. One speaker pointed out, however, that it is not necessary in all cases that the man selected be a worker in the same department.

Another speaker asserted that fraternalism among workmen sometimes makes it difficult to elevate one of them to foreman rank. Many felt this not to be an objection, for fraternalism is something to be desired and sometimes hard to establish. Some plants take steps to organize hobby clubs and other activities to promote fraternalism and close friendships. To choose a foreman from the ranks under such conditions is regarded as far wiser than

(*Continued on page 70*)

Views taken at the recent Chicago foundry show. Courtesy Sterling Farmer, Sand Products Corp., Cleveland

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***Pioneers in laboratory control of every car shipment, through a complete laboratory at each mill.***

**6** SUCCESSFUL SANDS from over 13000 acres of sand properties Selective in average grain fineness 26 to 280 . . . Ranging in permeabilities of 650 to 5 . . . We produce sands to meet individual specifications . . . Standard grades of sand need not be purchased.

## A. F. A. ANALYSIS

| | INDIANA | | TENNESSEE | | ILLINOIS | |
|---|---|---|---|---|---|---|
| GRADE | R-13 | T-5B | C-1 | P-5 | W-213 | SM |
| $H_2O$ | 7.60% | 7.60% | 6.50% | 3.20% | 7.00% | 6.00% |
| Permeability | 19. | 96. | 21. | 650. | 13.8 | 105. |
| Green S | 1.60 lbs. | 2.70 lbs. | 2.20 lbs. | 2.80 lbs. | 1.60 lbs. | 3.20 lbs. |
| Green C | 6 20 lbs. | 11.00 lbs. | 9.00 lbs. | 11.80 lbs. | 6.40 lbs. | 13.00 lbs. |
| Dry S | 19.00 lbs. | 19.00 lbs. | 12.00 lbs. | 3.00 lbs. | 17.00 lbs. | 8.60 lbs. |
| Dry C | 91.00 lbs. | 93.50 lbs. | 48.00 lbs. | 12.00 lbs. | 70.00 lbs. | 48.00 lbs. |
| Mesh 12 | | | | .20% | | |
| Mesh 20 | | .80% | | 19.00% | | |
| Mesh 30 | | 1.40% | .40% | 32.20% | | .20% |
| Mesh 40 | .20% | 6.00% | .60% | 24.20% | .60% | 1.40% |
| Mesh 50 | 1.40% | 24.80% | .60% | 11.00% | 2.40% | 8.40% |
| Mesh 70 | 3.40% | 28.40% | 2.00% | 2.40% | 7.20% | 17.80% |
| Mesh 100 | 21.80% | 7.00% | 13.00% | 1.80% | 11.80% | 26.00% |
| Mesh 140 | 19.00% | 2.80% | 33.00% | .80% | 7.60% | 12.00% |
| Mesh 200 | 13.20% | 1.80% | 30.00% | .20% | 16.60% | 6.20% |
| Mesh 270 | 3.60% | .60% | 2.00% | .00% | 12.00% | 2.40% |
| Pan | 21.00% | 4.20% | 1.40% | .20% | 27.30% | 9.40% |
| Total Screen | 83.60% | 77.80% | 83.00% | 92.00% | 85.50% | 83.80% |
| Clay | 15.40% | 21.20% | 17.00% | 8.00% | 14.50% | 16.40% |
| TOTAL | 99.00% | 99.00% | 100.00% | 100.00% | 100.00% | 100.20% |
| Deformation | .029 | .030 | .016 | .015 | .017 | .019 |
| Tensile | 15.10 | 9.90 | 16.00 | 22.50 | 73.00 | 15.70 |
| Sintering | 2544°F | 2575°F | 2687°F | 2868°F | 2571°F | 2615°F |
| A.F.A. Average Grain Fineness | 150. | 65. | 113. | 26. | 185. | 101. |

Most all our sands are available throughout the year dried to low predetermined moisture content.

***Write us regarding your individual sand requirements, or request a representative to call.***

**HOUGLAND & HARDY · INC.** **HARDY SAND COMPANY**

*Quality Sands* *Since 1910*

***Evansville, Indiana***

Many found opportunity to talk shop at the convention. Photos by Edwin Bremer

(*Continued from page* 68)

bringing a man from outside the organization.

Answering a question as to what a worker expects of a foreman, one member of the panel likened the foreman to the umpire in a ball game—he is close to the play and is in a position to render fair decisions providing he knows the rules. The responsibility of management is to make certain that he is taught the rules. The workman also expects the foreman to possess a sympathetic understanding. Continuing, this speaker gave his definitions for complaints and grievances. He said that a complaint is a matter which a workman carries to his foreman and which is adjusted there. A grievance is a complaint which is not satisfactorily adjusted by the foreman and goes past him to the management.

The policy of one large Michigan foundry is that a foreman must possess four attributes. First, he must be able to obtain quantity production; second, he must be able to obtain quality production; third, he must be a good teacher; and fourth, he must be consistent.

Opinion was in agreement that foremen should be acquainted with costs in the plant, particularly those over which they have some control. It was felt that foreman training is most effective when nontechnical training is given by the company management and technical training by outside experts. Because plants vary so much in size, no definite rules, it was believed, could be laid for a standard type of training.

In summing up the panel discussion, Chairman Lynch emphasized that the task of industry was to sell the American public on the soundness of the individual enterprise system which had made the country great, but which during the past 8 or 9 years has been made the target of radicals, crack-pots, and others who would introduce a new system. Only the individual enterprise system, he asserted, can continue the progress which gives Americans a living which is far above the subsistence level and the highest in the world. He maintained that the program of reducing working hours and maintaining present rates of pay will not solve unemployment because prices will rise and people will be able to buy less, therefore, production will drop.

# OPERATION OF CUPOLA

## Features Course

FIRST of four sessions in a gray iron shop course featured a discussion on cupola operation by John Grennan, University of Michigan, Ann Arbor, Mich., with P. T. Bancroft Republic Coal & Coke Co., Moline, Ill. presiding. The speaker presented a general review based on data collected during a series of tests conducted in the cupola operated in the university foundry. Studying conditions which seemed to indicate poor fuel efficiency, the experiments were run to determine if some method could be developed to attain full efficiency. Heats were run with coke bed varying in height from 11 inches to 52 inches above the tuyeres. In one instance the entire charge of 3600 pounds was placed on the bed coke, instead of being split into six usual charges of 600 pounds with coke between.

From the data collected the investigators drew conclusions which differ to some extent from those usually accepted. In adding more coke to the cupola to secure hotter metal, either by raising the height of the bed, or the amount of coke between charges, apparently the change in gas content from $CO_2$ to CO is not rapid enough to consume all the increase in coke. Some heat is lost in the increased CO content of the gases, but not in direct proportion to the increase.

Evidence also indicates that in no case, even with the cupola full of coke to the charging door 9 feet 8 inches above the tuyeres, was the

(*Continued on page* 72)

# "I want Easy Roll MonoRail!"

*"You mean American?"*

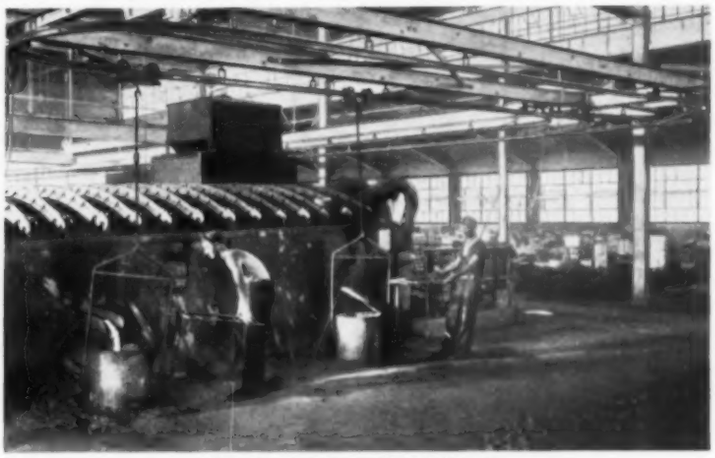
*"Sure, that's it! The track we put up the other day—the gang in the shop says the trolleys are so easy to push."*

*"That's right! I saw the first guy try it out. His load got away from him and rolled 30 feet down the track before it stopped. I guess he was used to our old rail."*

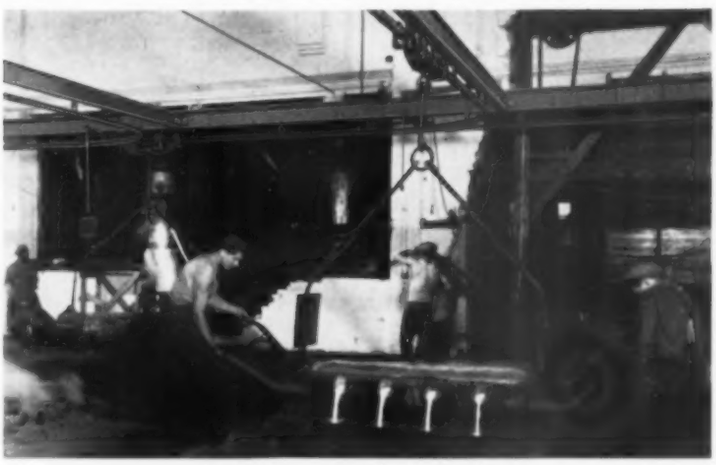
This actually happened in a large automotive plant where they originally installed their own overhead system. They now call for "Easy Roll" track, a name they coined after the above experience.

American MonoRail is "Easy Roll" because it's a high carbon, twin section rail, with overlapping splice to eliminate butt joints and a one piece forged hanger clamped in the rail head to prevent interference with trolleys. Trolleys "Roll Easy" because they contain precision bearings.

Let an American MonoRail engineer show you these features and explain the cost saving advantages of specialized overhead handling equipment.



Pouring loop in a malleable foundry.



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(*Continued from page* 70)

reaction

$$CO_2 + C = 2\ CO$$

completed. In the low bed charges it was shown that much of the reaction is carried on even when the metal melted is of minimum temperature to pour into molds. Ample coke is required to secure hot iron at the first and succeeding taps. The speaker favored a bed 52 inches above the tuyeres.

P. T. Bancroft presided over the second session on the shop practice course dealing with certain cupola features presented by Don J. Reese, International Nickel Co., New York. In his introduction Mr. Reese directed attention to the greatly improved physical properties found almost universally in present day cast iron. He pointed out that the cupola enjoys no monopoly in the casting field. Other types of furnace are employed to a considerable extent in melting iron quite satisfactorily. In certain instances this practically is mandatory. For example the air furnace is particularly adapted to melting large pieces of scrap, as found in roll shops and elsewhere.

**Materials Used in the Charge**

Discussing materials and charging methods the speaker cited instances where the charges were made up entirely of scrap, and others in which the scrap consisted of cement bonded briquets, iron borings and steel turnings. With the addition of suitable alloys and proper melting practice, the resulting metal met all the usual requirements. For special purpose he pointed out that the cupola is used for melting ferromanganese in connection with the bessemer process of making manganese steel, also for melting chromium and other elements used in alloying, and for melting copper and bronze. In view of the fact that steel is made in the converter by deliberately blowing a current of air either through the bath or over the surface, the speaker discounted a somewhat popular theory to the effect that iron becomes oxidized, especially over a low bed in the cupola. He concluded with a reference to the loss or pick-up of certain elements, carbon, silicon manganese, sulphur and phosphorus during the cupola melting process.

V. A. Crosby, Climax Molybdenum Co., Detroit, presided over the third session of the shop course Wednesday where S. C. Massari, Association of Manufacturers of Chilled Car Wheels, Chicago, described with text and illustration, method and equipment for controlling cupola operation by gas control. Description included details of a number of tests.

In an animated discussion which followed the formal presentation the speaker pointed out that the system could be used without or in conjunction with other methods and pieces of apparatus designed to regulate the blast in its function of supplying a maximum quantity of B.t.u.'s in a given period. He also directed attention to the fact that no piece of equipment devised up to the present will operate a cupola by itself. Experience and skill on the part of the melter still constitute the most important factors in producing iron for any class of castings including chilled car wheels, where uniformity is essential.

Final session of the gray iron shop course, with John Grennan, as chairman, featured discussion "Ladle Additions of Graphite to Cast Iron," by A. H. Dierker, Ohio State university, Columbus, O., and "Casting Defects Common to Automotive Gray Iron — Their Identification, Probable Cause, and Control," by W. B. McFerrin, foundry metallurgist, Cadillac motor car division, General Motors Corp., Detroit.

Mr. Dierker showed slides of tables prepared from results of numerous test ladle additions of graphite to gray iron. Results varied considerably, with tensile strength of the iron increasing in some instances and decreasing in others. Transverse strength improved in some, and declined notably in others. Deflection and brinell hardness also varied rather widely in final results. Subsequent discussion revolved about method of making additions, and matter of ash content of graphite.

Paper on casting defects by Mr. McFerrin, contained considerable information applicable to castings other than automotive gray iron. General classifications of defects include faults caused by shrinkage and contraction; cracks; hard spots; cold shuts; slag inclusions; gas holes, pin holes, blows; cuts or washes; scabs and rat-tails; drops, crushes; swells; sand inclusions; shifts; variance from pattern; run-outs; and roughness.

Factors necessary for production of good automotive gray iron castings were outlined by the speaker as follows: Adequate equipment properly manned; progressive supervision; proper metals and melting; best possible design of casting, pattern, and construction of pattern equipment; proper mold construction; proper core construction; suitable cooling time; proper cleaning operations; thorough inspection; and a complete, clear and concise set of records of each day's operation, correctly compiled and interpreted.

# COOL FOUNDRY SAND

## To Avoid Defects

PLANT and plant equipment session, attended by over 200 Monday evening, dealt chiefly with sand cooling and storage. James Thomson, Continental Roll & Steel Foundry Co., East Chicago, Ind., presided, with R. D. Brizzolara, American Steel Foundries, Chicago, and W. R. Jennings, John Deere Tractor Co., Waterloo, Iowa as co-chairmen.

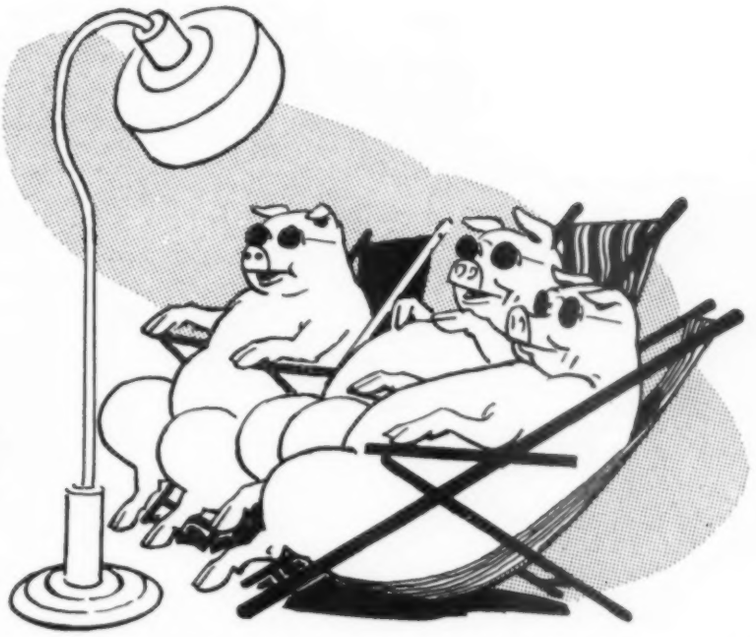
Using slides, F. H. Amos, International Harvester Co., Chicago, presented a trip through the foundry of the Harvester company's Indianapolis plant, which is a new shop and quite highly mechanized with the latest in foundry equipment. Views showed the yard, with its three cranes and magnets, as well as cupolas, ladles, and the monorail system for iron distribution and other uses. Numerous views were shown of the slag disposal system, the pouring stations, sand conditioning towers, and the hot casting conveyor. Diagram was presented of the sand handling system, which takes sand at around 220 degrees Fahr., ultimately delivering it at the molding floor at 80 degrees Fahr. unless outside temperature is higher. Shakeout station, with its suction, pusher, and fresh air ventilators, was illustrated.

Small casting unit in the plant has a 6-minute molding and pouring cycle, a half-minute dumping cycle. Core baking room has three recirculating type ovens, butane gas-fired at present. Feature of the plant is the modern ventilating system, exhausting 106,000 cubic feet per minute. The shop makes motor blocks, heads, wheels.

Greater part of plant session dealt with paper on cooling and storage of foundry sand, presented by H. L. McKinnon, vice-president, C. O. Bartlett & Snow Co., Cleveland. Facts stated were that moisture cannot remain constant when sand is hot, uniform strength is not possible at high temperatures, hot sand is likely to cause sweating on patterns and, if sand is properly

(*Continued on page* 74)

# We absorb heat FASTER!



U·S·S CARILLCO Piglets are designed for maximum heat absorption — faster melting. Careful research proved that their trapezoid shape exposes more surface per pound of iron, allowing heat to reach the interior of the pig quickly and evenly from all directions. The result is less fuel used, lower melting costs and more efficient production.

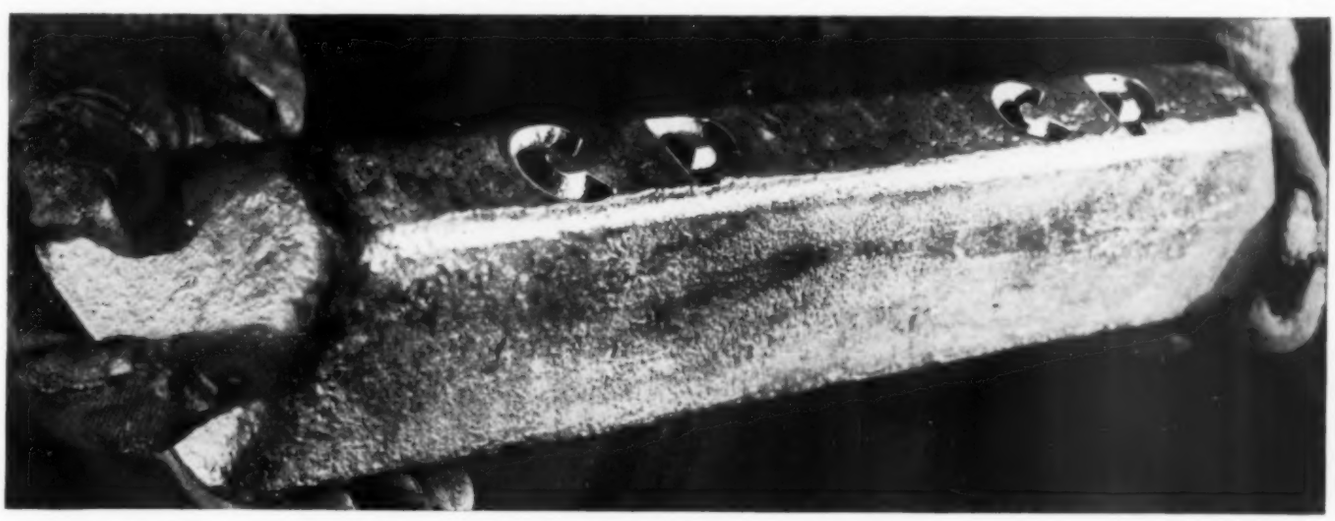
Easily handled CARILLCO Piglets cut labor costs. Weighing only forty pounds, they stack easily and safely. Their small size* makes even distribution of the furnace charge possible in a shorter time.

Fewer rejects occur when U·S·S CARILLCO Piglets are used. Their fine, uniform grain structure assures greater uniformity in the melt and finished castings. CARILLCO Piglets are *clean*—free from dirt, sand, kish and other foreign matter. And they are made from all ore iron.

Available in all ranges of silicon from .75 to 4.50% and manganese from .5 to 2%, their analysis is held within close limits. Whatever your specifications, you can be sure every shipment will reach you consistently uniform.

U·S·S CARILLCO Piglets are equally satisfactory for cupola practice or air furnace operations. For better castings and fewer rejects try them on your next order.

# U·S·S CARILLCO PIGLETS



AMERICAN STEEL & WIRE COMPANY • *Cleveland, Chicago and New York*

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**Carillco Piglet dimensions: Top (or bottom as cast) 17" x 1¾". Bottom 21" x 4¾". Thickness 2¾". They are uniform in size. Approximate weight—40 lbs.*

*Southern Pig Iron in standard form, produced by Tennessee Coal, Iron & Railroad Company, Birmingham, Ala., is also available for shipment throughout the Northern and Southern States. Utah Piglets are available on the West Coast from the Columbia Steel Company, San Francisco, Cal.*

UNITED STATES STEEL

(*Continued from page 72*)
cooled there is less chance for drops in copes. Modern day practice requires close attention to sand cooling problems. Suggested methods for cooling included passing sand through air in thin stream, addition of water, and spray of water on outside of a rotating shell.

Simplest practical method of cooling sand from above 200 degrees Fahr. is by addition of correct amount of water, together with agitation in a rapidly circulating atmosphere. In subsequent discussion J. R. Allan, International Harvester Co., Chicago, added further data on the subject of sand cooling.

Mr. McKinnon maintained the main storage bin for tempered molding sand always should have at least a 2-hour capacity. Storage bins have tendency to cake with sand. These should be cleaned as frequently as twice a month. There is no way to prevent such accumulation, but lacquer, glass, or stainless steel liners help some. In general, bin design should provide for stiffeners and columns to carry entire load. With regard to sand storage in molders' hoppers, these should be constructed with due reference to size of molds, and arranged so flasks may readily be put on or removed from machine.

# SAND COURSE COVERS

## All Four Branches

OVER 100 attended the first sand shop course held Tuesday morning under the direction of D. Frank O'Connor, Walworth Co., South Boston, Mass. The session was concerned with nonferrous foundry sand control. Discussion leader was Donald May, Crane Co., Chicago, who presented a brief outline on the various phases based on practice employed in that plant. In the discussion which followed, E. E. Woodliff, H. W. Dietert Co., Detroit, pointed out that, in general, for nonferrous work the clay content should be about twice the bond strength for best results, and since bond strength is in the vicinity of 7 pounds per square inch, the clay content will be 14 per cent.

In response to a question from the floor relative to the use of bentonite to increase bond strength of nonferrous molding sand, it was suggested that only 1 or 2 per cent be employed, and that the moisture content be reduced since bentonite requires less moisture for development of bonding property.

It was mentioned that as yet synthetic molding sands are not used to any great extent in nonferrous foundries; natural molding sands being quite satisfactory. In connection with the latter the most suitable bond strength is between 6½ to 7 pounds per square inch, and the moisture should be such that the sand by the feel test is what is termed *brittle*.

E. E. Woodliff presided over the second session of the sand shop course Wednesday at which Frank Brewster, Baker Perkins, Inc., Saginaw, Mich., discussed sand problems in the malleable foundry and Charles Schofield, Chevrolet Motor Co., Saginaw, touched in a similar manner on many details of gray iron foundry practice. The first speaker pointed out that malleable practice is different in many respects from that of other metals. Range of casting sizes is not so great, therefore one bank sand between 100 and 140 mesh with a small amount of sharp sand can be manipulated to handle most of the castings.

Permeability does not need to be over 40 to 50, green compression may vary from 5 to 10 pounds depending on the type of ramming. Moisture may be as low as 4 per cent for synthetic sand and up to 8 per cent for some natural sands. Sea coal content is between 6 and 12 per cent. Blacking sprays or plumbago cannot be used on the molds because the plumbago will affect the castings during the annealing operation. Recent trend in the rebonding of sand is the spraying of a clay suspension into the mixer. This is claimed to eliminate clay balls and reduces the amount of labor.

(*Continued on page 76*)

Attendance at the show was the largest in history. Photos by Edwin Bremer

*Modern Engineered Pouring Systems in Prominent Tractor Foundry.*

# 76 TONS OF METAL

distributed to and poured on this double line with a battery of seven Modern Pouring Devices. Castings ranging from a few ounces each to 35 pounds in the mold.

## Modern *Cylindrical Ladles*

1 ton capacity, distribute this metal to the 32 molder line. Hot clean metal is assured with these Covered and Insulated Ladles fitted with teapot spouts. Foundry scrap reduced to an absolute minimum.

Such real pouring efficiency can only be attained with a complete MODERN - engineered system as shown here. No conveyor installation can operate at full efficiency without this equipment.

In fact, no foundry can afford to be without it. Send for our catalogue on Ladles and Pouring Systems, describing latest developments along this line.

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*Patented & Patents Pending*

## MODERN EQUIPMENT COMPANY

PORT WASHINGTON, WIS., DEPT. 169

MODERN EQUIPMENT CO.

(*Continued from page* 74)

An animated discussion followed the presentation of both papers. The perennial question on whether it is advisable to change over from natural to synthetic sand was discussed to a considerable extent and from several angles. Further discussion centered around the advisability of reclaiming and using burned core sand. Experience at the plant of the Chevrolet Motor Co., Saginaw, indicates that waste molding and core sand can be reclaimed and used for the synthetic molding sand mixtures. The sand also is used as part of the mixture for cylinder body cores, but it is not suitable for the general run of cores, and besides the retreated sand requires an excessive amount of bonding material.

Under the chairmanship of E. C. Zirzow, National Malleable & Steel Castings Co., Cleveland, the third sand shop course was held Thursday morning. Discussion was led by Fred Weaver, Great Lakes Foundry Sand Co., Detroit, who described briefly core room practice, pointing out the wide range of core binders available either singly or in combination. They include pitch compounds, resins, cereal bonds and core oils. He stressed in particular the necessity of maintaining moisture content at the lowest possible point since its removal is expensive.

**Angular and Round Grains**

In reply to a question as to whether the round grain or angular grain was most suitable for cores, Mr. Weaver said that he had not investigated the subject sufficiently to give a definite answer. He said that the angular grain requires less sand for a given volume, and round grain sand stands more ramming without losing permeability. Reclamation of core sand received some attention, and mention was made of several ways in which that was being accomplished experimentally. In one case it was found that a good mechanical scrubbing which removed the excess carbon coating and fines, gave satisfactory results. Another speaker mentioned that he had tried heating to 1200 degrees and quenching in water which gave an excellent appearing sand. However, when made into cores it did not have the desired strength, and microscopic examination revealed the sand grains to possess a film of clay, due probably to the mixing of mold and core sand during shakeout. About 10 per cent of the recovered material could be used with regular core sand.

It was pointed out that before considering reclamation of core sand it would be well to study carefully all the factors concerned. Primarily it was one of economics involving the cost of new sand at the plant, removal of old sand, etc. At the close of the session it was mentioned that a new hardness meter for cores was available which measures scratch hardness.

At the shop course session Friday under the chairmanship of L. H. Hahn, Sivyer Steel Casting Co., Chicago, the subject of steel foundry sand was discussed by D. D. Cameron, Chicago Heights. In the presentation of this subject and in the prolonged discussion afterward, Mr. Cameron claimed that to maintain proper control the foundryman should specify washed and dried sand. The other usual specifications, silica content, grain size, etc., may vary to some extent depending on individual shop methods, sand handling equipment and class of castings. He pointed out that crude silica sand contains approximately 5 per cent water, but also a greater or lesser amount of silt and impurities. It does not present economy to pay freight on material that either cannot be used, or that costs money to remove. Touching on the subject of reclaimed sand he admitted that with proper equipment and under skilled supervision, a certain amount may be employed in making molds and cores, but a hazard attaches to the use, therefore greater care is necessary in the preparation and manipulation.

For medium to heavy weight castings made in green sand molds the speaker claimed the grain fineness of a suitable sand lies between 36 and 45. In his opinion good castings in weights up to 10 tons can be made in green sand molds. Permeability, of course, must be high to take care of the great volume of steam generated by heavy masses of metal. With a good open backing sand he suggested a permeability of 200 to 250. Later in an impromptu question period he pointed out that permeability in the backing sand really is more important than high permeability in the facing. Permeability of 25 is sufficient in sand for dry sand molds. High points in the mold should be provided with suitable vents for the escape of expanded air and for the prevention of locks, missruns and wrinkles.

For small bench and squeezer castings made in green sand molds a permeability of 60 to 80 is satisfactory. This sand has a grain fineness 92 to 96. With the ample sand testing equipment available he deprecated the custom of guessing at the permeability, green and dry strength and moisture content of the sand. On the subject of the connection between cracks and metal temperature he mentioned an instance where an increase in the metal temperature stopped the formation of cracks. This was ascribed to the theory that the hotter metal broke down the core to a greater extent and thus permitted free contraction.

# CUPOLA REFRACTORIES

## Compared in Paper

A WELL-ATTENDED session Tuesday evening under the joint chairmanship of A. H. Dierker, Ohio State university, Columbus, O., and J. A. Kayser, Laclede-Christy Clay Products Co., St. Louis, heard two papers on refractories: "Comparison of Refractories for Cupola Service," by J. A. Bowers and James T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala.; and "Linings for Desulphurizing Ladles," by John Lowe, Vilter Mfg. Co., Milwaukee.

In the first paper comparison of cupola refractories was based on refractory costs for ordinary 21-inch and 54-inch diameter circular cupolas and a 72 x 102-inch oval shaped unit. Figures presented showed costs both with and without labor charges. Each refractory tested was shown to be economical under certain conditions, not so good under others.

One refractory showing a silica content of 95.58 per cent was described as a super-refractory, but with certain cost limitations, and not economical for all types of operations. Another stone lining, 94.87 per cent silica was shown to be about equal to fire brick, but sufficiently economical to warrant its usage in spite of higher laying costs. Ultimate conclusion further brought out by subsequent discussion, indicated that periodic cost studies of refractory use in any foundry are of prime importance in selection of the proper refractories.

In the second paper, "Linings for Desulphurizing Ladles," presented by John Lowe, the speaker showed a number of slides and stressed essential points in selection of linings.

(*Continued on page* 78)

# WHY IS IT. . . .

**THAT TOP RANKING CONCERNS, THOUGH NOT COMPELLED TO DO SO, ARE IMPELLED TO INSTALL WALKER-YORK FURNACES FOR NONFERROUS MELTING?**

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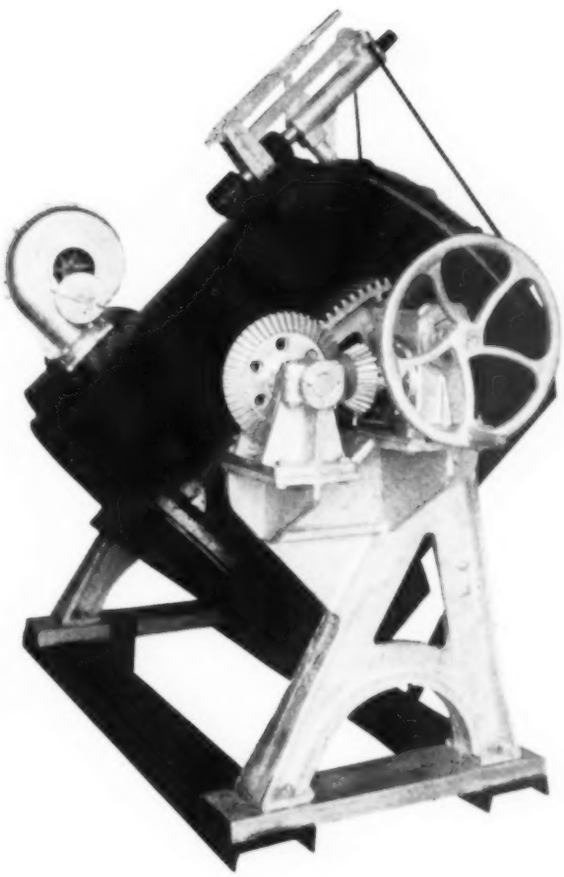


## CRUCIBLE FURNACE COMPANY

**CHARLOTTESVILLE, VA.**

(*Continued from page* 76)

Illustrations of before and after conditions showed the effects on various materials. Weight of desulphurizing agent per ton of metal and pounds per heat were discussed, with results of both incorrect and correct lining usage shown. The illustrations showed in a graphic manner the distortion and ill-effects of incorrect linings for particular jobs where conditions varied.

# EVALUATION OF JOBS

## Discussed by Group

JOB evaluation, and time and motion study were the subjects considered at a five-man roundtable conference on Friday afternoon. The panel board comprised Chairman F. E. Wartgow, industrial engineer, American Steel Foundries, East Chicago, Ind.; co-chairman H. C. Robson, industrial engineer, Continental Roll & Steel Foundry Co., East Chicago; J. A. Westover, supervisor standards and time studies, Burnside Steel Foundry Co., Chicago; W. E. George, assistant to management, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.; and E. J. Metzger, general superintendent, Falcon Bronze Co., Youngstown, O.

Job evaluation was divided into four general subtopics—job description, labor definitions, wage standardization and merit rating. Mr. Wartgow indicated that in his plant, all odd rates have been eliminated and wages standardized in 2-cent increases. Mr. Metzger observed that standardization lessened labor turnover by giving the workman a clearer picture of his future. The good job of rate classification accomplished by the Steel Founders Society of America was cited.

On the question of merit rating, the conflict with union shop agreements naturally was a leading problem. However, as Mr. Robson noted, a careful system of records, collaborated on by superintendents, foreman and time study men, can give concrete evidence of an employe's ability over a period of time, which is the only evidence worth anything in NLRB hearings, should such hearings have to be encountered.

Mr. Westover described a system in use in his shop where varying classes of work are received regularly, and of course varying skills in workmen are present. Each job is classified according to the number of units of work in it, *A* jobs being most complicated, *B* jobs not so involved and *C* jobs relatively simple. When *A* jobs are not available for *A* workmen, then the latter are given *B* jobs in lieu of sending them home. Even though the rates on *B* jobs are lower, the *A* workmen, because of their higher skill can earn nearly their normal rate on *A* work.

With regard to time and motion studies, extended comment developed on such matters as personnel of the department, type of payment, standardization of incentive rates, setting of standards and training of employes. Mr. Wartgow observed that a time-study man can do more harm than any other man in a plant if he is not the right type of man. While education is important, common sense was held to be about 98 per cent of such a man's qualifications.

In considering straight piecework, task and bonus, and group bonus systems of payment, each type appears to have its best adaptation in certain foundry departments. The task and bonus system, for example, is good in cleaning departments; the straight piece work system appears best in coremaking and molding departments where it provides a measure of close control, according to Mr. Westover. The group bonus system finds use where costs are too high to keep detailed track of what is done by individuals.

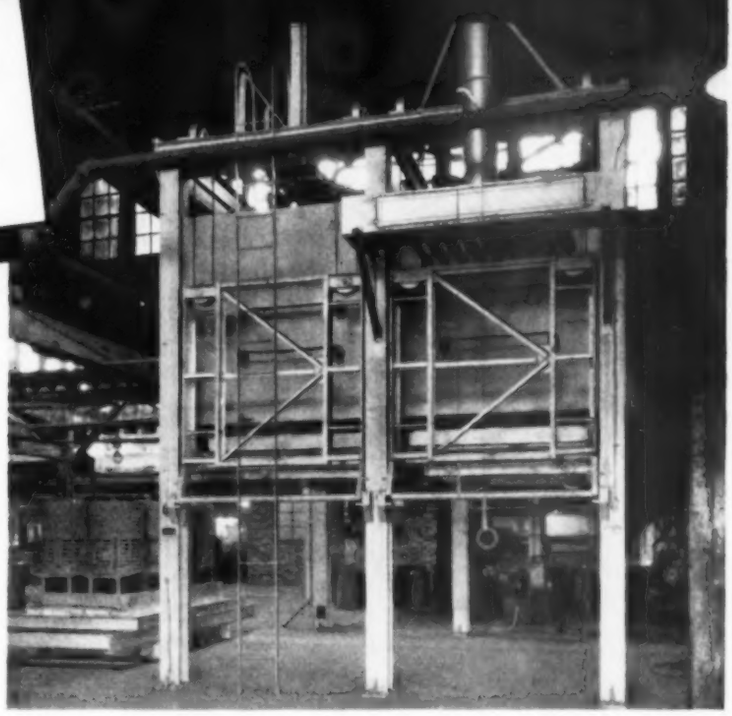
Mr. George advised setting standard rates on the basis of a good man working hard, then applying premiums over the base rate, so that it may be possible for an exceptional workman to earn 20 per cent over what the "good man working hard" makes. But he is further recommended careful analysis of each job and accurate determination of the correct method for each job, so that

(*Continued on page* 80)

Amphitheatre was the meeting place for friends. Photos by Edwin Bremer

# ANNEALING TIME CUT FROM 7 DAYS TO 1

## WITH THIS G-E BATCH-TYPE ELECTRIC FURNACE

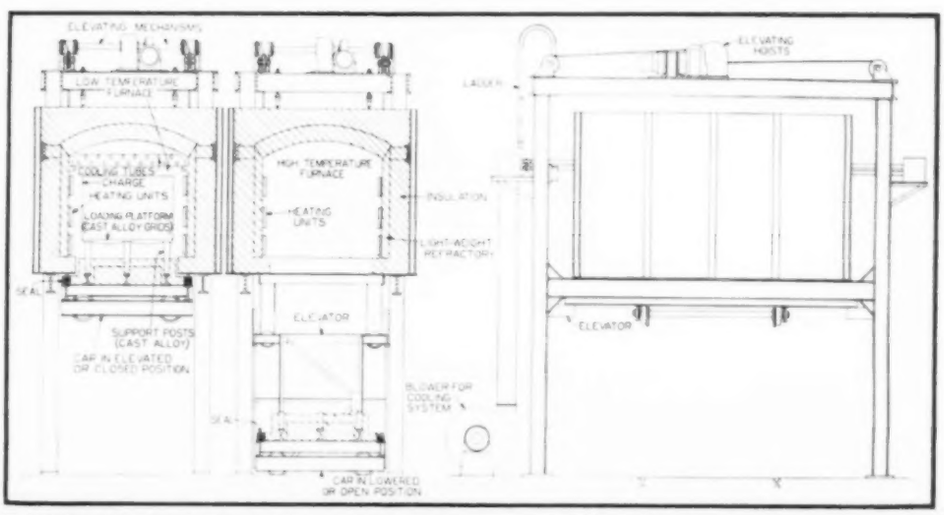


This G-E two-chamber furnace provides for the rapid heating of a charge in the high-temperature chamber while a previously heated charge is being cooled, equalized, and held in the low-temperature chamber for the remainder of the cycle

A MIDWESTERN manufacturer reduced annealing time from 7 days to 24 hours and greatly lowered production costs when he replaced an old fuel-fired furnace. Now, with a modern G-E two-chamber electric furnace, a net production of 16 tons of castings is annealed in one day. The short time cycle means less inventory and more on-time shipments.

Lightweight alloy containers replaced heavy cast pots. The expense of labor and material for packing the castings is avoided, and working conditions are improved. Accurate automatic control of the time-temperature cycle, temperature distribution, and atmospheric conditions assures constant uniformity of products and reduces rejects.

Perhaps the G-E two-chamber furnace is the solution of *your* annealing problem. If not, General Electric can also supply the single-chamber or continuous type in the right size for your foundry. Discuss your requirements with a heating specialist in the nearest G-E office. General Electric Co., Schenectady, N. Y.




### THIS G-E BATCH-TYPE FURNACE OFFERS CONTINUOUS-TYPE ECONOMY

The two-chamber furnace can be applied to provide efficient service where production doesn't justify the use of a continuous-type furnace. Its flexibility enables it to provide economical annealing over a wide range of load, from intermittent or varying production of a small foundry to heavy day-after-day output.

GENERAL ELECTRIC

675-9

(*Continued from page* 78)
once the standard rate is set, there will be no deviation from it.

Mr. Wartgow pointed out that a good time-study man must in reality be a motion-study man. The camera system is being used widely for motion studies, although it is not so readily applicable in the foundry industry as in some others.

Mr. Metzger discussed the development of a card index system of work standards, with its attendant values on cost analysis and labor relations.

Methods of training employes were considered by Mr. Robson who recommended that supervisory personnel be selected from the plant and not from the outside, perhaps making use of older men for that type of training. Mr. George pointed out that all foremen in his plant are selected on the basis of their ability to do quality work, to do quantity work, to be able to teach other employes, and to be consistent in their attitudes and decisions under every condition.

# FLOWABILITY OF SAND

## Subject of Study

PROGRESS report on work on synthetic sand mixtures, being conducted by Fulton Holtby and H. F. Scobie, instructors in foundry practice, University of Minnesota, Minneapolis, was presented by Mr. Holtby at a sand research session on Thursday morning. First section of the report was devoted to consideration of occurrence and properties of the St. Peter sandstone formation found throughout midwestern states. The material is available in large quantities in the vicinity of Minneapolis and is used by local foundries there for core sand. It is nearly pure silica and of nearly uniform composition.

Various mixtures of the material for synthetic molding sand were made, one being known as No. 10 mix and comprising 24 parts of new sand, ¾ part bentonite, ¼ part cereal binder and 1½ parts water. Dry ingredients were mulled 3 minutes, water added and the wet mixture mulled 5 minutes. Sand mixture was found to have good durability in molds, with permeability seeming to improve with use. Adverse features included the tendency for molds to dry on the outside surfaces if left several days before pouring, and the roughness of the casting surface if the metal was poured too hot. Both of these troubles are minimized after the sand is used several times.

The authors concluded their investigations with a study of the utilization of waste steel fines for gray iron molding. Such fines regularly are removed from molding sand by steel foundries to maintain high permeability, and usually will run from 200 to 500 pounds per ton of steel castings produced. It was determined that steel sand fines can be used as molding sands of low permeability and as blending sands to control the properties of molding sands of similar composition.

In this connection, an investigation has been started by these authors to study the rapid drying of synthetic sands. Preliminary work substantiated the belief that glycerine is useful in preventing drying. Work with various wetting agents such as asbestos fiber alkali and alkaline earth oxides demonstrated that while the wetting agent is not effective in reducing drying, at a critical moisture content the green compressive strength increases to double the strength obtained with plain water and the same percentage of bond.

Official exchange paper of the Institute of British Foundrymen, "Report on Sand Control in the British Foundry Industry," by J. J. Sheehan, Austin Motor Co. Ltd., Birmingham, England, was presented, in the absence of the author, by Rufus F. Harrington, Hunt-Spiller Mfg. Co., Boston.

Most pressing problems among British foundries, which have adequate academic facilities, ample raw materials of high quality and the technical ability to use both the knowledge and the materials, is the need for a wider distribution of technical ability. Of lesser urgency is the necessity of continually adding to the knowledge already possessed.

In Britain the quality of the natural molding sands is being maintained by new additions of prepared clay. In green sand practice, the ratio of dry to green strength is being balanced by like additions. In dry sand practice, horse manure, sawdust, chopped straw and cowhair all are being dispensed with and adequate temporary dry strength is being obtained by suitable additions of cereal binders, and expansion effects minimized by controlled additions of graded coal dust or silica fines.

Green sand practice is extending in the steel foundries and, for medium weight castings dry sand practice is gaining ground from the old "compo" mixtures—combinations of old firebrick, graphite crucibles, coarse silica sand, fireclay pots, etc., all crushed to less than ⅛-inch size.

Report of the A.F.A. foundry sand research committee was made by the technical director, Dr. H. Ries, Cornell university, Ithaca, N. Y. Among other things, he discussed details of fineness tests and a comparison of results submitted by several different laboratories. He suggested that inaccuracies in sieves, not generally recognized, might arise through holes, slits, spreading of mesh, excessive blinding and wearing of wires. Reports on life of sieves varied, one being in excess of 1000 tests for 20 mesh and finer, another being 18 months on the basis of six tests daily.

### Solid Support Needed

Importance of solid support for the ram in making an accurate ramming test was emphasized by Dr. Ries, as well as the character of the specimen. His committee also is working on a new method to determine core hardness, involving substantially the pulling of a metal plow across the core and then measuring the depth of penetration. Other work is devoted to developing new definitions, study of sand mixtures at high temperatures, consideration of specifications, analysis of clay distribution in sands and methods of its removal. Dr. Ries pointed out that much investigation still remains to be done, to the end that simpler and more uniform sand mixtures may be available to foundrymen.

A paper, "Some Considerations of Effects of High Temperature on Sands," by G. W. Ehrhardt, Cornell university, Ithaca, N. Y., was presented by title.

Four papers provided a very full and interesting program for the foundry sand research session on Wednesday afternoon, May 8. W. G. Reichert, foundry metallurgist, American Brake Shoe & Foundry Co., Mahwah, N. J., served as chairman, and R. F. Harrington, foundry superintendent and chief metallurgist, Hunt-Spiller Mfg. Corp., Boston, as co-chairman.

Flowability of molding sands was the subject of a paper by Peter E. Kyle, assistant professor of mechanical engineering, Massachusetts Institute of Technology, Cambridge, Mass. Mr. Kyle defined flowability as the property which enables the

(*Concluded on page* 82)

# "ELEMENTARY FOUNDRY TECHNOLOGY"

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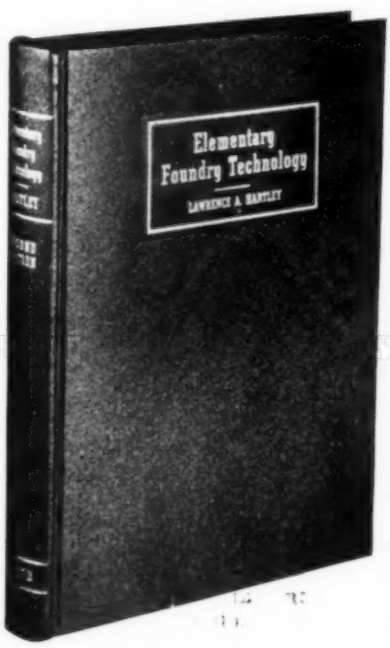
● Fundamental data on both foundry practices and those related subjects of importance to foundrymen are thoroughly covered for the use of apprentices and young men studying modern foundry management and operation.

This book, a fully revised second edition, contains material conforming to the requirements for instruction as set up in the minimum standards of four year foundry apprenticeship in the United States. It is sponsored by the National Founders Association, Chicago.

Well over half of the book is devoted to discussion of fundamentals of foundry practice, with special reference to the field of gray iron and steel manufacture. In this, the second edition, material has been revised and brought up to date to include much of the progress made in the foundry industry in recent years, and new sections have been added. Foundry subjects covered include . . . Elements of Iron . . . Iron Manufacture . . . The Cupola and Its Operation . . . Elementary Problems in Steel Foundry Production . . . Brass Melting . . . Foundry Sands . . . Gates and Risers . . . Molding Machines . . . Core Machines . . . Long Life Molds.

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"Elementary Foundry Technology", by L. A. Hartley; Second Edition revised by Edwin Bremer and Pat Dwyer; 377 pages; 6 x 9 inches; 132 illustrations, 16 tables; includes glossary, index and bibliography; sponsored by the National Founders Association, Chicago; Price $3.00, postpaid; Published by The Penton Publishing Co., Cleveland.

(*Concluded from page 80*)
sand to be forced around a pattern at the proper hardness without producing undesirable conditions at other parts of the mold. Two methods of measuring flowability, namely, the hardness differential method and sand movement method, were discussed, and comparisons drawn with the method suggested by earlier investigations.

Of the tests mentioned, Mr. Kyle said the hardness gradient method seems the most sensitive. Results of tests show that further work in development of this method should be continued in the hope that its simplicity can be retained and its accuracy and sensitivity increased. Microscopic study of the flow action and an attempt to explain any laws of flow which may be developed by other methods will be pursued.

Effects of sand moisture and permeability on various properties of gray iron were discussed in a paper by Harry W. Dietert and E. E. Woodliff, president, and sales engineer, respectively, Harry W. Dietert Co., Detroit. The authors found that fluidity, feeding, transverse strength and deflection are reduced with excess moisture in the sand. Fracture is finer, graphite refined, steadite areas reduced in size, ferrite areas increased in size, porosity increased, and chill increased, with excess moisture.

### Fluidity Was Reduced

Fluidity was reduced, fracture is finer and lighter color, graphite is refined, and size of steadite areas reduced with increased permeability. Pearlite areas are more completely developed in low permeability sands and less completely developed with larger areas of ferrite with high permeability. The authors also found that moisture has a greater influence on properties of the gray iron than permeability, although the latter exerts a noticeable influence.

Contributing a progress report on an investigation of the influence of the mold on shrinkage in ferrous castings, H. L. Womochel and C. C. Sigerfoos, Michigan Engineering Experiment station, East Lansing, Mich., advanced a theory for their results which involves the expansion or contraction of the mold walls.

According to their findings thus far, piping tendencies, internal shrinks and sinking of the cope face may be correlated with dimensional changes in the mold cavity; high moisture, high green compressive strength, soft ramming and unfavorable grain distribution of the sand tend to promote shrinkage defects in gray iron; sea coal decreases the amount of piping in gray iron poured in green sand; small gray iron castings made in baked core sand molds show no shrinkage defects; and steel castings are less susceptible to influence of the mold than gray iron castings.

In the final paper, Harry L. Daasch, professor and head of mechanical engineering department, University of Vermont, Burlington, Vt., dealt with sand bond strength and heat of wetting values. Bentonite-sand mixtures and natural sands were studied. Curves and calculations indicate a general relationship between strength and heat of wetting which seems to apply to sand-bentonite mixtures.

Prof. Daasch asserted that rigorous mathematical application of heat of wetting theory is not recommended, for the present for natural molding sands. Cases were cited wherein heat of wetting theory and calculations may be used as a measure of the efficiency of bond substance.

# PATTERNMAKERS PROBE

## Coatings and Colors

SUMMARY of the adaptability of the A.F.A. standard pattern color chart was made by G. V. Lustig, Barber-Colman Co., Rockford, Ill., who stated that after considerable study it was found not to be sufficiently complete for his plant, so a new arrangement was drawn up in 1931 and amended in 1939. Distributing samples of his chart for inspection to the 150 attending the patternmaking session Tuesday afternoon, he threw out a number of questions for discussion as follows:

1. Is it possible to arrange some color plan which can and will be adopted universally throughout the A.F.A. territory?
2. Is any color plan of real value unless it is complete in every detail?
3. Should foundrymen be expected to be able to interpret the meaning of pattern markings if every pattern shop has a different plan?
4. Is it right for each and every pattern shop to suit itself on markings, regardless of the wishes of the foundries?
5. Is it fair for foundrymen to place the blame on the pattern shop for the loss of castings if the A.F.A. color chart is incomplete?
6. Should it be necessary to distinguish between finished and unfinished surfaces on patterns for brass and aluminum?
7. Are standard pattern colors really of great importance when we consider that metal patterns have no color?

For some years the matter of pattern coatings has been a question which has been discussed at some length but with little satisfaction; so, in response to a request, Frank C. Cech, Cleveland Trade school, Cleveland, and Vincent J. Sedlon, Master Pattern Co., Cleveland, collaborated on a survey of the various coatings used in industry, their methods of application, preparation, materials and pigments used, solvents, etc.

Results of the survey showed that (1) three of four prefer flake to cut shellac, (2) shellac flakes are cut by covering with solvent over night, stirred the next morning and thinned out to proper consistency, (3) grain alcohol is little used as a solvent, (4) patented solvents are replacing wood alcohol rapidly, (5) black extract is superseding lampblack as a pigment, (6) vermilion red is a two-to-one favorite over other shades, (7) yellow pigment is little used, (8) aluminum powder, mixed with shellac or varnish, is gaining favor, (8) oxalic acid should not be used as a clearer for high-grade shellac, (10) rubber-set brushes with rubber binding, are favored, (11) crockery shellac containers are favored, (12) future pattern coating probably will consist of a shellac priming coat followed with a lacquer top coat, (13) pattern spraying is impractical, (14) a majority of patternmakers prefers A.F.A. standard colors, and (15) pattern purchasers should specify the number of castings to be made from the pattern when ordering it.

In the general discussion which followed the two papers, Vaughan Reid, City Pattern Works, Detroit, and chairman of the meeting, said he was not sold completely on the need for marking metal patterns, since most of them are for large production jobs and molders are thoroughly familiar with the patterns, making incorrect use of them almost impossible.

In discussion of color markings on patterns, it was brought out that some jobs are of such a rush character that no time is available for marking. Furthermore, some jobbing pattern shops prefer to use clear shellac.

# BRAKE DRUMS FOR HEAVY DUTY

(*Continued from page* 34)

metal actually to upset itself in localized areas. Because of their prominence on the surface of the drum these areas now become the main contacts between brake shoe and drum and, therefore, carry the frictional load. This serves to increase further the temperature of the metal at these spots and further volume increases result. When the metal in these localized areas cools, contraction produces stresses in excess of the tensile strength of the material, resulting in failure which is manifested by a network of fine cracks or *crazing*.

### Origin of Heat Checks

Observations made subsequent to the first few applications of the brakes show that such spots are present on the surface of the drum and that they are the origins of these so-called *heat checks*. Convinced that these areas were definitely a factor in the thermal checking of brake drums, one organization interested in the brake drum problem used an abrasive material in their test brake shoes in quantities sufficient to remove these spots as soon as they were formed. This caused complete elimination of heat checks but increased drum wear appreciably.

It is significant to note that thermal checking has been observed in metals which undergo no phase changes at all, and in this case, unequal thermal expansion alone is responsible for the crack.

Almost invariably, however, in the case of ferrous alloys, combination of simple thermal expansion and dimensional changes resulting from passing through the critical range are involved. Volumetric changes occurring in ferrous alloys which exhibit the alpha to gamma transformation are of even larger orders of magnitude per unit rise of temperature than those produced by simple thermal expansion. For that reason effects of allotropic changes should be given adequate consideration in studying thermal checking.

When iron alloys transform from the body centered cubic lattice to the face centered cubic lattice, an appreciable contraction takes place. During heating, the alpha or body centered iron expands by simple thermal expansion until its critical temperature is reached, at which time a sharp contraction takes place. The gamma or face centered iron formed at the critical range then expands again at a somewhat increased rate (approximately twice that of alpha iron) of thermal expansion. Upon cooling the reverse holds true. Gamma iron cools and contracts until it reaches a temperature at which it will transform to the alpha state, where a sharp expansion takes place followed by contraction of the alpha iron on further cooling.

When a thin surface layer goes through these volumetric changes, while adjacent layers, because of their lower temperatures, remain practically in their original position, it readily can be seen that a complexity of stresses must be produced which will tend to cause fractures in the thin, heated layer. These fractures will appear as fine cracks.

Investigation has thus far failed to associate the network of thermal checks with any network or solidification pattern in the structure of the material.

### Thermal Cracks Are Dangerous

Thermal checks themselves may not cause failure directly. However, their presence is deleterious to the drum because they develop into fatigue cracks which extend into the body of the drum and eventually cause failure. Because of the ultimate danger involved, the drums on buses and trucks are removed from service whenever these cracks appear in large quantities.

In a recent private communication, a large user of brake drums stated that the higher carbon irons possess a definite advantage in resistance to checking. The conclusion was based on several hundred tests made in an engineering laboratory. These tests are run on disk type brakes. Braking surfaces are held in a vertical position and brake shoes applied by transverse pressure. The load is supplied by a 19,000-pound rotor mounted on a shaft which is connected directly to a motor and to the brake drum of the material being tested. For these tests a deceleration rate of 2.5 miles per hour per second from a velocity of 100 miles per hour to a dead

**Table IV**

## Effect of Carbon and Alloys on Tensile Strength

| | Analysis | | | | | | | Tensile Strength | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T.C. | C.C. | Si | Mn | Cr | Ni | Mo | Room Temp. | 700°F. | 800°F. | 842°F. | 932°F. | 1000°F. |
| Plain Iron A. | 3.29 | 1.10 | 1.27 | 0.28 | . | . | .... | 34,300 | 34,200 | ..... | 33,100 | ..... | 22,200 |
| Cr-Ni ..... | 3.19 | .65 | 2.13 | 0.58 | 0.34 | 0.67 | ... | 29,800 | 37,200 | ... | 31,400 | ..... | 21,000 |
| Plain Iron B. | 3.63 | 0.73 | 1.15 | 0.54 | 0.03 | 0.03 | .... | 33,000 | ..... | ..... | ..... | ..... | 24,800 |
| Cr Iron..... | 3.46 | 0.87 | 1.36 | 0.68 | 0.54 | .... | .... | 42,000 | ..... | ..... | ..... | ..... | 34,200 |
| Plain Iron C. | 3.36 | .... | 1.82 | 0.40 | .... | .... | .... | 41,200 | ..... | ..... | ..... | 24,200 | ..... |
| Mo 1..... | 3.32 | .... | 2.04 | 0.46 | .... | .... | 0.21 | 42,500 | ..... | ..... | ..... | 26,200 | ..... |
| 2..... | 3.36 | .... | 2.00 | 0.48 | .... | .... | 0.42 | 45,000 | ..... | ..... | ..... | 27,800 | ..... |
| 3..... | 3.25 | .... | 1.80 | 0.40 | .... | .... | 0.60 | 48,500 | ..... | ..... | ..... | 33,200 | ..... |
| 4..... | 3.25 | .... | 1.81 | 0.40 | .... | .... | 0.86 | 53,400 | ..... | ..... | ..... | 39,400 | ..... |
| 5..... | 3.27 | .... | 2.08 | 0.44 | .... | .... | 1.05 | 52,800 | ..... | ..... | ..... | 37,800 | ..... |
| Cr-Mo 1..... | 3.40 | .... | 2.00 | 0.53 | 0.29 | .... | 0.24 | 43,000 | ..... | ..... | ..... | 26,200 | ..... |
| 2..... | 3.30 | .... | 2.02 | 0.55 | 0.29 | .... | 0.34 | 45,200 | ..... | ..... | ..... | 28,900 | ..... |
| 3..... | 3.40 | .... | 2.00 | 0.55 | 0.29 | .... | 0.72 | 50,200 | ..... | ..... | ..... | 32,700 | ..... |
| 4..... | 3.30 | .... | 1.90 | 0.51 | 0.27 | .... | 0.84 | 52,600 | ..... | ..... | ..... | 36,000 | ..... |
| 5..... | 3.45 | .... | 2.00 | 0.55 | 0.29 | .... | 1.00 | 53,500 | ..... | ..... | ..... | 37,400 | ..... |
| Climax | | | | | | | | | | | | | |
| 1790 ..... | 3.39 | .... | 1.93 | 0.83 | 0.22 | .... | 0.50 | 41,300 | ..... | 38,300 | ..... | ..... | 28,700 |
| 1791 ..... | 3.36 | .... | 1.93 | 0.83 | 0.24 | .... | 1.03 | 52,800 | ..... | 48,400 | ..... | ..... | 38,900 |
| 1808A .... | 3.79 | .... | 1.06 | 0.82 | .... | .... | 0.51 | 31,700 | ..... | ..... | ..... | ..... | 21,900 |
| B .... | 3.82 | .... | .... | .... | .... | .... | 1.00 | 33,900 | ..... | ..... | ..... | ..... | 23,300 |
| C .... | 3.80 | .... | .... | .... | .... | .... | 1.88 | 42,200 | ..... | ..... | ..... | ..... | 32,600 |
| D .... | 3.80 | .... | .... | .... | .... | .... | 2.70 | 45,800 | ..... | ..... | ..... | ..... | 39,300 |

Table IV was compiled from data obtained from 3 separate sources:
1. Plain iron A and the chromium-nickel iron were reported in ASTM-ASME Creep Data Report, 3/38 pps. 708 and 710.
2. Plain iron B and the chromium iron were reported in Transactions AFA, vol. 38, page 839, 1930 "Effects on Cast Iron of Prolonged Heating at 800-1100 degrees Fahr.," by McPherran and Krueger.
3. Plain iron carbon, molybdenum irons 1-5, and chromium-molybdenum irons 1-5 were reported in the "First Report of the Research Committee on High Duty Cast Irons for General Engineering Purposes"—J. G. Pearce, director, British Cast Iron Research association. (The paper was presented before the Institution of Mechanical Engineers—12/16/38.)

stop was selected as a standard "stop." The number of stops which a drum can withstand before thermal checking appears on the braking surface is taken as the criterion of the ability of the material to resist this type of failure. Table I shows the advantage gained by the use of higher carbon contents in cast iron.

It is indicated that the ideal brake drum iron must contain a high percentage of carbon, probably in the range between 3.60 and 3.80 per cent. The difficulty involved in the use of irons with these high carbon contents is their low tensile strength and low impact resistance. To make use of the resistance to thermal checking offered by this group of irons, some way of strengthening them must be developed. It is here that the advantages of alloy additions may be considered.

Exactly why the higher total carbon cast irons are more resistant to heat checking than compositions of lower carbon content is not clearly understood. However, it seems probable that ability to resist this type of surface failure is related to the manner in which the matrix is broken up by the graphite flakes. The problem then is one of properly alloying the matrix of a high carbon iron without appreciably reducing the graphite content. The matrix may thus be somewhat hardened and materially strengthened without affecting resistance to thermal checking, or without introducing any machining difficulties.

### Test Three Heats

With the foregoing information as a basis for development, three heats of cast iron were produced in the laboratory. Standard (A.S.T.M.-A124-29) arbitration test bars 1.2 inches in diameter were cast and tested. Chemical analyses of these heats are recorded in Table IV and are identified as heats 1790, 1791 and 1808A, B, C, D. These heats were prepared and tested to study effects of alloy additions on the strengths of the higher carbon cast irons. A study of these irons indicates that sufficient alloy additions can increase the strengths of cast irons containing 3.80 per cent carbon sufficiently to produce physical properties comparable to those of the lower carbon (3.20-3.30 per cent) irons. Strengths of the higher carbon alloyed irons at elevated temperatures are equal to the strengths of the lower carbon irons at the same temperatures.

An additional advantage is gained by the use of alloy additions in cast iron brake drums. Increase in strength resulting from these additions increases resistance to *upset* at the braking surface and also reduces the tendency to crack under the stresses set up by contraction during cooling. In this manner, alloy additions which increase the physical characteristics of the matrix improve the resistance of cast iron to thermal checking.

Previously the use of high carbon cast irons for brake drums or braking disks had received little attention, due to the weakness of this type of material at normal temperatures. When it was proved that alloy additions could increase the strengths of these irons to the point where they could be considered safe, reliable engineering materials, manufacturers were more inclined to accept the possibilities offered, and tests were conducted to determine the ability of the irons to withstand the abuse to which braking surfaces are often subjected.

### Test Two Alloy Irons

The same organization that conducted the braking tests described above tested two alloy irons and submitted the results given in Table II.

The two drums used in the above test were designed for an application where weight was not a vital problem, hence a larger section of a weaker iron was satisfactory and the alloy content could be kept fairly low.

Table IV has been compiled to illustrate the effects of carbon content and alloy content on the tensile properties of cast iron at room temperature and at elevated temperatures. Some of the irons had not been developed specifically for brake drum applications and are included for the purpose of comparison only.

Table III has been compiled from published data to illustrate a variety of compositions now being used or tested for heavy duty brake drum service. No service data were available to the authors on any of the compositions except No. 5. One particular set of brake drums cast from this analysis is reported to be in service on a large bus after 171,718 miles. (At this mileage the drums were removed for inspection and reinstalled). Results thus far observed indicate that their service life will exceed 200,000 miles.

Compositions of two cast irons used in airplane brake drums are included in the table as Nos. 9 and 10. Composition No. 11 is being employed successfully for braking disks on streamlined trains.

Since thermal transformation of iron-carbon alloys with its attendant volumetric changes is partly responsible for the phenomenon of thermal checking, the brake drum problem may also be attacked along the line of eliminating the alpha to gamma transformation altogether, or raising the critical range to a sufficiently high temperature to reduce its effectiveness under the conditions to which brake drums are subjected in service.

Elimination of the transformation by addition of an alloy or combination of alloys which possess the ability to *close the gamma loop* may offer some excellent possibilities for solving the problem of thermal checking in brake drums. Carbon usually must be kept low so that these elements may be used efficiently and, as a result, hardnesses are usually too low and strength too much reduced to prevent scoring. However, it is possible by proper adjustment of alloy content and carbon concentration to produce a composition which will possess the requisite hardness and tensile strength and still eliminate thermal checking. At first thought such compositions will appear commercially impractical because of their high cost, but a drum that will give long service will more than pay for itself by decreasing maintenance costs and replacements.

It is fully realized that this article cannot be a complete treatise concerned with the problem of brake drums for heavy duty service. The authors have attempted to present, in a brief form, the problem of developing a suitable material for this application, some of the theoretical and practical considerations that must receive attention, suggestions and supporting evidence for a partial solution, and some possibilities for further research and development.

## Melting Furnaces

Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, England, has issued to its members an 80-page booklet containing a report on "Melting Furnaces for Gray Cast Iron" which discusses the application of crucibles, air furnaces, electric furnaces, and cupolas. Various features of each type with information on linings, operation, etc. are given, and the booklet concludes with cost data on each.

American Nautical academy, National Training school for merchant marine officers, Washington, has announced a program whereby young men from 11 to 21 years of age may secure practical ship experience on board the training ship of the academy within the period from July 1 to October 1. Young men may remain on board the ship for the entire period or for any short time they wish, but not for less than a month. There is no tuition charge for any of the courses offered by the academy.

## STRIKE UP THE BAND

(*Continued from page* 26)

admiralty bronze. Nickel bronze castings are made in two grades. The first contains nickel 18 per cent, copper 54 per cent, zinc 27 per cent and lead 1 per cent. The second mixture is made up of nickel 20 per cent, copper 50 per cent, zinc 29 per cent and lead 1 per cent. The nickel silver is poured at a temperature of 2400 degrees Fahr., aluminum at 1250 degrees, and bronze at 2000 degrees.

The metal is melted in two oil fired crucible type furnaces made by the Fisher Furnace Co., Chicago. Pots are No. 50 which means that each pot has a holding capacity of 150 pounds of bronze, or approximately one third that amount of aluminum. The crucibles are used first for melting the refractory or high melting point mixtures. When they show signs of wear they are transferred to the second furnace where the aluminum is melted.

### Flux Silver Mixtures

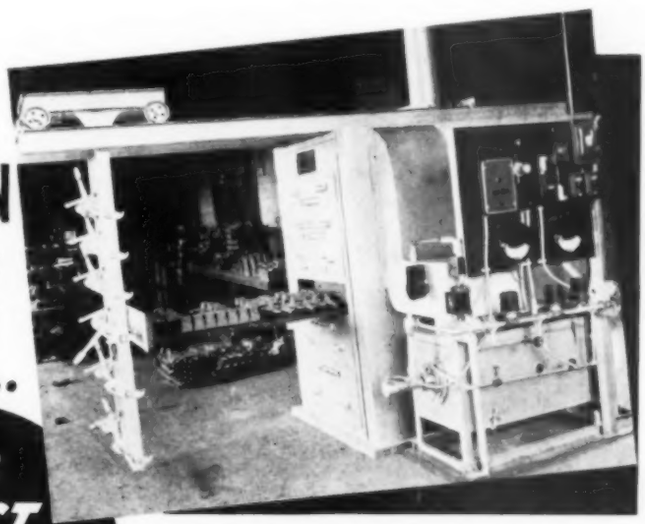
Flux for the silver is made up of equal parts soda, borax and charcoal. About 1 pound of this mixture is placed in the bottom of the crucible, followed by the silver ingot metal and the return gates and sprues. A similar amount of the flux is placed on top of the metal which is melted and brought up to a temperature of 2400 degrees Fahr.

Molten bronze is treated in a manner which to say the least up to the present has not been adopted in general nonferrous foundry practice. The bent end of a small steel pipe is pushed down to the bottom of the pot and moved around while a jet of compressed air blows through the metal. The operation is illustrated in Fig. 6. It is claimed this agitation of the metal throws any occluded gas and foreign material to the surface. The gas escapes and the scum is scraped from the surface before the clean metal is poured into the molds.

Advantage is taken of local conditions to provide a clean atmosphere in the furnace room. Originally this room housed a boiler for supplying steam. After the furnaces were set up a large rectangular hood was suspended at a height to clear the heads of the operators. A suitable pipe connected the opening in the apex of the hood with the former boiler connection opening in the chimney. The natural draft in the chimney draws all the smoke and fumes from the furnaces and from the pots on the floor during the skimming operation. This tendency may be noted at the lower left Fig. 6, where the fumes from the crucible, instead of rising straight up and contaminating the furnace room atmosphere, are drawn toward the hood—not shown—over the furnace.

Good housekeeping methods prevail in the foundry and in all parts of the immense plant. Melting and pouring crews are equipped with all modern safety devices including goggles, safety shoes and leggings. An exceptionally clever device is used to prevent the pot from tipping in the shank during the pouring operation. Device and method of application are shown in Fig. 1. A piece of steel 2 x ¼ x 12 inches, bent to a slight arc, is welded at the center to the side of the shank.

Men familiar with boats or nautical terms will recognize it as a cleat. A second piece of flat steel is bent to form a hook at one end while the other end is attached to a length of light chain. Before commencing to pour the metal, the crucible man attaches the hook to the rim of the crucible at a point approximately in the center and opposite the lip. The slack of the chain then is

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wrapped around the cleat. After all the metal is poured the crucible is tipped to an upright position and the device is removed as easily and quickly as it was applied a few minutes previously. Two or three turns of the chain around the cleat anchors the crucible firmly. The free or dangling end of the chain remains cold enough to handle at any time.

Molds are rammed by hand over a row of sand tubs or troughs placed close to the wall which in this instance is mostly glass. The molds are stacked four high for convenience in pouring and for economy of floor space. On account of this method of pouring the sprue of each mold is placed in the center close to one end of the flask. A single weight on the top flask is sufficient since each mold serves as a weight for the mold directly beneath. All molds are made in metal flasks of the general size and shape shown in Fig. 3, fitted with either two or four guide pins adjusted to the nicest accuracy.

Each flask is provided with a metal bottom plate and a second plate for the top on which the following flask rests. Plates prevent the sand from straining when the mold is filled with molten metal. The main frame and branches of the runner are in the drag, but a cotinuation or rib over each branch forms a cavity in the cope which serves for a dirt catcher and feeder. Exceptionally large runners are required to convey metal to the great number of individual castings. Some castings present no particular or difficult features, while others need the most skillful handling in molding and pouring. Difference of a rammer stroke close to the edge of a flask may determine whether the casting in that vicinity will pass inspection.

A fine grain Indiana sand is used for making the molds. Physical characteristics include moisture 7 to 9 per cent, strength 4 to 6 pounds, clay content 4 per cent, permeability 4. Molds for silver are dusted with starch while the bronze molds are dusted with flour. The faces of the aluminum molds are not treated.

### Castings Easily Cleaned

One feature missing in this foundry is a casting cleaning room. The reason is that the castings do not require cleaning. After they are shaken out a workman passes a broom over them to remove small scattered areas of clinging sand as shown in Fig. 5. They are then ready to go to the sprue cutter shown in Fig. 4. This is a foot operated veteran of many years standing and may be replaced by a power driven unit, before this description appears in print. The sharp eyed operator removes each tiny casting from the gate in a manner to leave little or no metal to be removed later in the finishing operation. The castings fall into a light, portable chute and then slide down into a pressed steel pan for removal to the machine shop.

A research department in the Conn plant constantly develops and introduces new features or improvements on existing instruments or instrument parts. Where new castings enter the assembly, the procedure is substantially the same as in any manufacturing establishment. The designer prepares a drawing which is submitted to the foundry superintendent who also has charge of the pattern shop. He has the individual patterns prepared in wood. A skilled molder lays them out to the best advantage on a board with runners and guide pins in place. The guide pins attached to the drag side of the runner as shown in Figs. 3, 4 and 5 are designed to assist the molder in securing a perfect draw when the pattern is in use later.

After the drag is rammed and rolled over, the molder carefully makes a parting around each item flat in some instances, but usually irregular in outline. A substantial wood frame made from 2 x 2-inch

THAT'S the report of one Maehler Oven user; 26 tons of molds in various sizes were baked in 7 hours for $2.75. Don't compromise with averaging heat—high cost, hit and miss core baking. A Maehler Oven with oil air-heat bakes cores uniformly perfect at less expense than normal coke firing and with no hot spots, no burnt core corners. In another case a foundry had 4 brick rack ovens, coke heated. 2 more were needed — however they decided to install a Maehler Conversion Unit, with oil heat, for 2 of the old brick ovens. The results were so effective that the other 2 old ovens are not used. Our files are full of these typical examples — let a Maehler Engineer look over your system and perhaps suggest a way to more efficient, more profitable core baking.

**THE PAUL MAEHLER CO., 2200 W. Lake St., Chicago, Ill.**

wood stock is placed on the drag in the position normally occupied by the cope. The frame is filled with liquid plaster of paris. After the plaster solidifies, the frame is removed from the drag, inverted and if necessary, touched here or there. It is allowed to dry for approximately 24 hours and then is ready for use as a follow board. Several typical boards are shown in Fig. 2. No pins or pin holes are needed to locate the drag on the follow board. Slight deviation in any direction is not an item of importance, since the follow board is removed after the drag is rolled over, and the cope is rammed directly on the drag.

The follow board and patterns shown at the top of Fig. 2 are for making the flashing bulbs on the ends of the batons proudly wielded by drum majors in half knee length boots and fancy uniforms considered essential to the peculiar high stepping gait or ceremonial movement of the brotherhood. In recent years the female of the species has invaded this one time purely masculine field with an improvement roughly estimated at 75.504 per cent in the snap-snap, the grace and the skill with which they put 'em down, and pick 'em up!

The castings are aluminum, gated in the manner shown in the illustration. Metal from a sprue near one end of the cope enters the runner cut in the drag face of the mold. An extension to the end of the runner catches any dust or other foreign material coming down with the first dash of metal. With the rectangular block shown between each pair of patterns, the cores anchor themselves automatically and do not need chaplets. The castings later are plated and polished to a mirror like finish.

## Prevent Hot Tears In Steel Castings

(*Continued from page* 28)

ings showed that no cracks were encountered until the cores approached a core hardness of 90. The cores used in producing commercial castings did not exceed a core hardness number of 60. Evidently while variations in core hardness can cause tearing, this variation must be of such magnitude that it could not occur with normal commercial control. If such deviation should occur by accident it would be detected readily.

Data gathered from this series of tests did not offer a solution to the problem of variation in cracking intensity sometimes encountered in similar castings poured from heats of identical chemical composition.

In the next step the same test pattern was employed to investigate the effect of pouring temperature on hot tear formation. Six test molds were prepared for pouring on each heat with cores of a hardness number of 60. This core hardness number was constant for all cores used in this investigation. Three molds were poured with hand pots with the first metal from the bull ladle. The other three molds were poured with the last metal from the bull ladle. The average time between pouring the first set of molds and the last set was 30 minutes. This time was average for the 20 heats tested.

Results of this series of tests were very erratic. Castings poured from some heats showed a decided difference in cracking intensity between the first and the last set. Other heats showed no difference. They were perfectly solid cold poured as well as the hot poured sets. No definite relationship could be established between pouring temperatures and tearing. The only fact established was that all the castings which showed cracks were poured with the last metal from


*Another* HANDLING PROBLEM Solved...for Malleable Foundry

Views of recent Chicago Tramrail installation in the malleable foundry of the Wm. E. Pratt Mfg. Co., Joliet, Ill.

THIS installation, it may be noted, has been designed in a manner to off-set the hoist itself from the excessive heat directly over the furnace, and all operating controls are located at one end. Our experience has included the design of handling equipment for every department of the malleable foundry.

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the bull ladle on excessively hot heats.

The fact that all castings which showed cracks on any heat were those which had been poured from the last metal in the ladle suggested the possibility that some change had taken place during the holding of the metal exposed to the action of the slag and atmosphere. Upon this assumption microscopic examination of specimens cut from the various castings seemed advisable.

Results of microscopic examination were gratifying in that a definite relationship was established between the presence of hot tears in the test castings and the inclusion types. Figs. 1 and 3 show respectively the inclusion types in the castings poured on one heat. Fig. 3 shows the inclusions, (type 3), in the castings poured in the early part of the heat which were free from hot tears. Fig. 1 shows inclusions (type 2), characteristic of those present in the castings poured in the last part of the heat which showed decided tears. Consideration of these micrographs will show that the inclusions in the castings free from cracks are type 3 as described by Sims[6] and consist largely of $Al_2S_3$. Those castings which showed tears, although poured on the same heat all evidenced the presence of type 2 inclusions to a greater or lesser degree.

This evidence seemed to point to the presence of type 2 (Fig. 1) inclusions as the controlling factor in the consistent production of crack free castings when normal core and molding practices are followed. Further substantiation of this idea was obtained by conducting tests varying inclusion types while holding core-hardness constant. Cored molds were placed at the furnace ready for pouring. After the final additions of silicon and manganese were made to the furnace and well stirred in, a ladle of the metal was withdrawn.

Aluminum wire was added in controlled quantities, varying from 0.02 to 0.20 per cent in successive ladles. The castings poured from metal so treated showed a very direct relationship between hot tear formation and the inclusion types. The short space of time allowed for distribution of the aluminum sometimes caused difficulty in obtaining sulphides in type 3 arrangement. Very often an addition of 0.20 per cent aluminum did not cause complete elimination of the type 2 inclusions. However, since all castings were examined for inclusions this did not cause any confusion. The facts observed in these tests may be briefly summarized:

### Inclusions Cause Cracks

(1) All castings showing type 1 inclusions, (Fig. 2), were free from cracks. (2) All castings showing type 3 (Fig. 3) inclusions were free from cracks. (3) All castings showing type 2 (Fig. 1) inclusions were cracked. (4) Those castings showing a mixture of type 2 (Fig. 1) and 3 (Fig. 3) inclusions varied in cracking intensity.

The author does not wish to be understood as believing that all hot tears are attributable to the presence of type 2 (Fig. 1) inclusions. This article deals only with castings which have been produced successfully with standard core and mold practices, but which occasionally tear when poured under apparently identical conditions.

Conditions described were caused by a lack of sufficient residual aluminum in the steel to withstand oxidation attendant upon holding of very hot metal exposed to the action of slag and atmosphere for as long as 30 minutes. Consequent oxidation of the residual aluminum resulted in a reversion of inclusion type from type 3 (Fig. 3) to type 2 (Fig. 1) with the hot tears resultant in the castings poured from the last metal in the ladle. This condition was remedied readily by addition of more aluminum to the fur-


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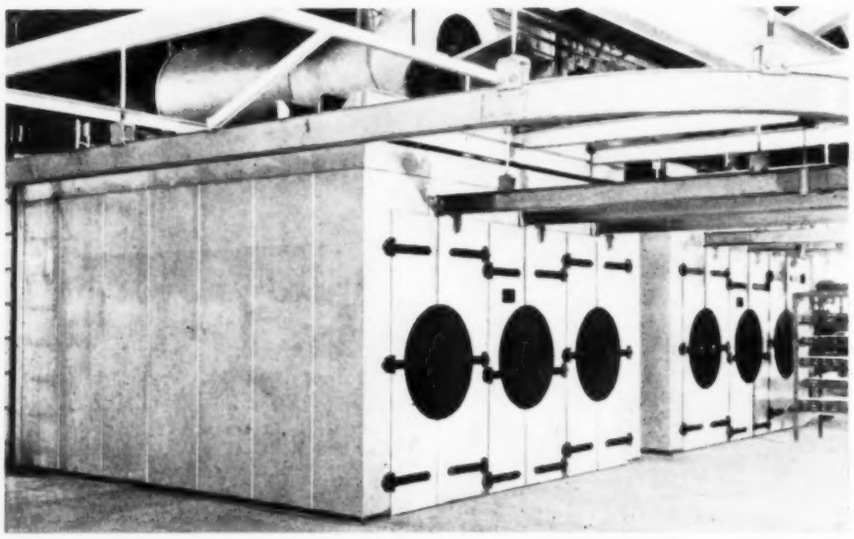

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nace to leave a larger residual amount in the metal. In this case increasing the final aluminum addition from 0.10 to 0.15 per cent proved effective in producing a consistent inclusion type in the hottest heats produced.

Variation in cracking intensity is especially prevalent in shops where aluminum is added in the stream while pouring the metal. Under such conditions it is impossible to avoid the occasional presence of type 2 (Fig. 1) inclusions.

The following facts may be presented as a result of the experiments:

(1) Belief that hot pouring tends to the formation of tears may be traced according to Karl Singer[4] to the fact that very hot heats are not treated any differently than the normal melts in respect to deoxidation. The author does not agree with Singer that ferrous oxide (FeO) as such is a factor in the formation of tears. However, it appears that the effect of ferrous oxide (FeO) on inclusion types is important. When deoxidizing practices are established it is essential that they be sufficiently flexible to cover any possible variations in furnacing methods.

(2) Pouring temperature is a negligible factor in controlling the formation of hot tears.

(3) Variations in core hardness sufficient to cause a change in cracking intensity must be of readily discernible magnitude.

(4) Steel showing the presence of type 2 (Fig. 1) inclusions will have a definite tendency to crack badly.

(5) Steel showing the presence of type 2 (Fig. 1) and 3 (Fig. 3) inclusions will vary in cracking intensity, depending upon which type predominates.


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5—Studies on Solidification and Contraction and Their Relation To the Formation of Hot Tears in Steel Castings; Briggs; *Transactions* A.F.A.; Vol. XLI; page 385.

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## Book Review

*Transactions* of the American Foundrymen's association; cloth; 989 pages, 6 x 9 inches; edited by Robert E. Kennedy and Norman F. Hindle; available through the office of the association, 222 West Adams street, Chicago; $3.00 to members and $15 to nonmembers of the association.

This bound volume No. 47 of the *Transactions* of the association covers the proceedings at the Cincinnati convention, May 15-18, 1939, including the president's annual address, summary of proceedings, reports of officers, financial statement, minutes of board meetings. Greater part of the almost 1000 pages is devoted to a transcript of 48 technical papers with accompanying discussion presented at the various sessions of the convention. This is probably the most valuable set of foundry papers ever compiled on any given occasion, written by recognized authorities in the four main fields, gray iron, malleable iron, steel and nonferrous, of the foundry industry. An extensive index at the back of the book provides a means of ready reference either under author's name, title of paper, or subject matter.

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# YOUTH IN FOUNDRY INDUSTRY

(*Continued from page 29*)

ing all the different phases of our industry. It is apparent that youth has a very definite opportunity in the foundry industry. Retiring age must be replaced by youth. The personnel must be maintained. The young man must acquire what he can from age; but also he must accept information with an inquiring mind that will enable him to understand and fully comprehend the mistakes that age is prone to make so that he can avoid making the same mistakes. Admittedly, of course, he will make many mistakes; but it is hoped that they will not be the same ones made by those who preceded him. After youth, by service as an apprentice or learner, has learned what he can from age, he must attack the foundry problems with an open mind. Unless he does attack them with the distinctive courage of youth, there is little hope that hidden secrets or improvement in our industry will be uncovered. We may be sure that youth will meet the challenge with courage. We are challenged on all sides by the development of new materials, or improvement in the quality of old materials, either of which may be offered as a substitute for castings on the supposition that they offer an improvement in service or price, or both. The foundry industry must meet this challenge by developing better castings at lower costs, better alloys from which the castings may be made, and above all, a better knowledge of how to use castings intelligently so that they may give their maximum service and insure their rightful position in engineering construction.

### Youth Has Opportunity

We hear a great deal about the opportunity for youth in the development of new materials that promise solution of many engineering problems. Youth has an opportunity in most industrial life. In the foundry industry there is a very great opportunity for youth to attack the problem of improving the rapidity with which castings are made from materials that he also has found means to improve in their fundamental quality. There is every reason for the statement that there is a vast opportunity for youth to develop foundry technique, foundry conditions of light, of ventilation, of material handling, of all those conditions that make for improved working conditions and improved health for all in the industry that will result in an increase in productivity of the industry of the highest quality castings that youth is sure to develop.

Men associated with the foundry industry for many years undoubtedly have seen opportunities for improvement in their respective plants and attempted to make these improvements as opportunities were presented. They have attacked them with a certain reserve born of the conservatism of age, the diffidence born of fear of undue cost. Youth should bring to bear on these identical problems the optimism of those who are not influenced by ultra conservatism or the conviction that experience has shown that it cannot be done. All too frequently we are inclined to assume that something cannot be done when at the same moment somebody else is doing it. Opportunity for youth to improve casting quality is a very large one, since he can attack that improvement problem from three different directions.

### Improve Metal Quality

He can improve the quality of metals in the castings through the increasing knowledge of metallurgy and how to apply that increasing knowledge. Only a very short time has elapsed since scientists have made available pure raw materials in such vast numbers. In the early days of the foundry industry almost all raw materials were contaminated by the presence of more or less troublesome impurities. These impurities were present in major portions in some instances, and in relatively small portions in others, but almost always these impurities have led to difficulties. They have influenced the physical characteristics of the resulting materials and only now are beginning to be understood. It would not be difficult to cite many instances of where there is still argument as to the probable influence of the presence of the elements that are not desired necessarily as a component part. Furthermore, metallurgy is beginning to be able to study this problem of the effect of additional elements, either added intentionally or resulting from the inadvertent addition by reason of their presence in some of the impure raw materials.

Youth has a vast opportunity to benefit industrial life by studying the effect of varying proportions of the different elements in different metallurgical compounds. It should be emphasized that any attempt to understand the influences of small or large additions of other elements than those indicated as desired in the specification, should be attacked with an open mind. To assume that a certain impurity does or does not have a certain effect and then try to gather evidence to prove the point always will result in proving correctness of the assumption. Obviously this is a very gross mistake in the method of research.

Youth will do well to learn from the experiences of those who have gone before that no research problem is successful that starts out with assumed answer and then proves that answer. Any person can isolate a sufficient number of items that might be construed as facts to prove an assumption. If he gathers all the facts and properly balances them against one another the assumption may be proved to be wrong. Youth's opportunity lies in doing the research without any predetermined bias so that errors made by those preceding him may be corrected.

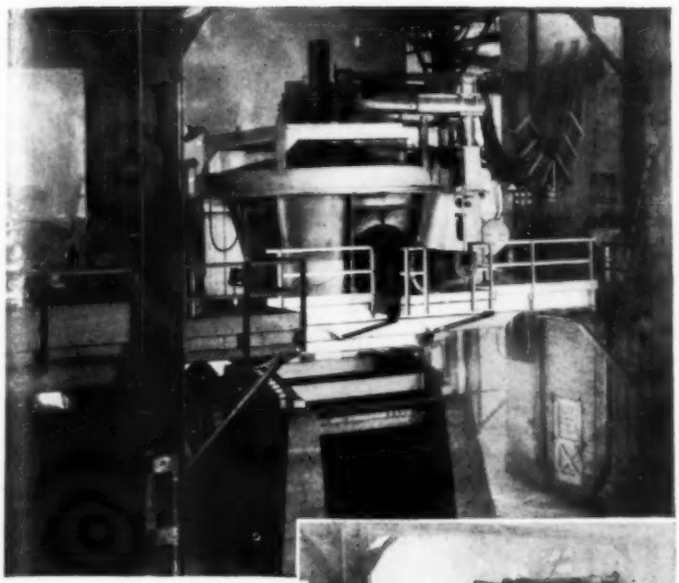
A minimum number of errors in conclusion from research may result from the work of youth. With such metallurgical development on the part of youth, the foundry industry may look forward with confidence to many useful alloys, many improvements in the present alloys and many developments of immense value in cast structural materials that will increase the usefulness of the foundry industry many fold.

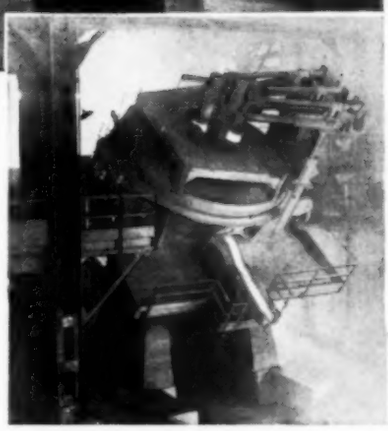
### Study Foundry Equipment

Improvement in molding methods, molding materials and the materials handling, resulting in improved cost conditions present opportunities. Molding materials may be of two general types offering vast opportunities for improvement. Sand and molding equipment for handling and holding sand are being studied with a vast amount of improvement in their .service already visible. There is still much for youth to do in the improvement of these very vital items in the foundry.

In the permanent mold or metal mold materials there is also a great deal of opportunity for improvement since this process of casting metals in permanent or semipermanent molds only recently has become of commercial importance. Improvement in the knowledge of metallurgy also can affect the metallurgy in the metals used for the production of these molds. Cost of preparing molds for foundry operation is an item of first magnitude; therefore, anything that will serve to reduce that cost is important. Development of an improved material that will stand heat and yet machine readily or cast to size readily, or in some way arrive at the finished condition for the production of castings at a more economical cost and at the same time produce a larger number of castings before being worn out.

(*Concluded on page 92*)





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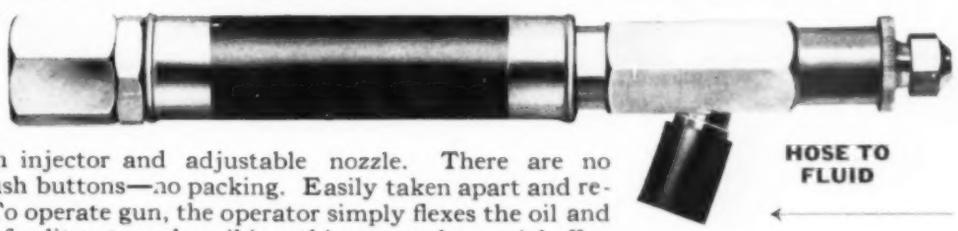


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(*Concluded from page* 90)

will be of great benefit to this branch of the foundry industry.

There is great promise in this field for youth, since casting in metal molds, either centrifugally, under pressure, or under the force of gravity, is going to be applied increasingly to production of cast parts. Youth has a big part in the study of that branch of the foundry industry and in particular the equipment in the form of proper molds for that type of castings.

Improvement is possible in the working conditions of the workmen that will enable them to produce more of the higher quality product per hour with less fatigue, less hazard and more congenial and happier living conditions. Study of working conditions has received a good deal of consideration in recent years, probably more than in the entire previous history of the foundry industry. Production is more rapid and the drive for accuracy and uniformity of products is more insistent. Men must be able to see better, consequently they need better illumination. They must be able to operate their mechanical devices more rapidly and with more precision. This requires maintenance of more consistent conditions in equipment and supplies.

### Study Ventilation

Since more metal is being poured and sometimes poured at a higher temperature than heretofore, atmospheric conditions are more liable to be troublesome, thus requiring the study of ventilation, and of proper drafts on chimneys and venting apparatus. Present management recognizes that a healthy workman is a happier and more willing workman and can produce better and more work with less fatigue than a workman handicapped by ill health. Protection of the workmen's health is a vital factor. Regardless of the humanitarian side, it becomes a very important factor to industrial management in the race for better products at lower costs.

Youth has a challenge here in that there is a definite rivalry among manufacturers to attract the best workmen. The shop best equipped to make comfortable working conditions uniformly available to the men will find the best men gravitate to it, resulting in the production of the best product. Plant design, is something that youth can tackle with optimism. Equipment, supplies and the economical handling of them is a further challenge for youth in this phase of the foundry industry.

A fourth opportunity for youth to improve the success of the foundry industry has little to do with the production end. This is improved knowledge of how to apply castings to engineering construction, so that they give a greater satisfaction in service, and thus earn an increased usefulness that insures an increase in the demand for castings.

Competition is bound to be keen. This will only whet and sharpen the edge necessary to attack the problem if youth meets that competitive challenge. Youth best can meet that challenge by co-operating with one another and studying the problems that confront industry in conjunction with fellow workers in the American Foundrymen's association; in the meetings of the annual convention, and the meetings of the several chapters throughout the United States and Canada. They can take their problems to these forums for open discussion and frank expression of opinion. Each problem is attacked with the thought that the solution may be the stepping stone to further opportunities for uncovering successful methods for improvement of quality, successful methods for improvement of speed in production or other methods of economical service of the industry to engineering construction.

In some instances castings have been denied their rightful place on the assumption that some other type of structural material either was more economical or would give a more satisfactory service under existing working conditions. Designers aware of the fundamentals involved might have realized that wrought or forged materials do not possess the correct crystal structure to withstand the service for a time that would compare with the life possible with cast materials having the proper type of crystal structure.

### Improve the Quality

Youth can increase the spread of knowledge of the useful influences of cast materials and their proper application. At the same time, youth must be prepared to improve the standard of quality of castings so that uniformity of material may be available regularly to satisfy engineering service. Engineers may feel that many castings are satisfactory but there is a hazard connected with castings due to their irregularity that is not present in some of the other types of structural materials. Uniformity of castings quality will remove this doubt from the minds of designers.

There is no reason why the incoming generation in the foundry industry should not develop such a high order of uniformity of product that engineers will readily agree that if one cast part has proved itself for a service in engineering construction, duplicates will repeat this experience. The industry can deliver over and over again that same high order of quality necessary to complete confidence on the part of the engineering designers.

Much of the doubt about uniformity of castings has been reduced materially during tthe past several years. The foundry industry has reason to be proud of the increasing confidence engineers are showing in cast parts. There is a great deal of room yet for improvement. Metallurgy opens up opportunities yet only scratched. Many other opportunities will open up as the present visible opportunities are more thoroughly understood.

Finally we say to youth: The foundry industry is one of the oldest of the industrial methods for production of useful metal parts. Today it offers opportunities for development, ingenuity, imagination that are unexcelled by any other branch of industrial life.

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## Ills and Cures in Nonferrous Foundry

(*Continued from page* 31)

shrinkage defects, they are either too small in diameter, too short, or a combination of both. They may be placed too far away from the sprue, the source of hot metal. Obviously if a riser is to function properly it must provide a reservoir of hot liquid metal to feed back into the casting as solidification progresses.

Not only should risers of adequate diameter and height be located properly, but the connection between riser and casting never should be pinched or reduced in size to the extent that the metal in this area will have the slightest tendency to congeal before the casting solidifies. A reduced connection between riser and casting will defeat the very purpose of providing a hot molten metal reservoir commonly known as a riser.

What good is a riser if, instead of providing the necessary reservoir of hot molten metal to feed back into the casting, it actually contains the coldest metal in the mold? When a riser is located on a remote part of the casting, far away from the sprue, the molten metal must flow through the entire mold cavity and perhaps around one or more cores before it enters the riser. In a case of that kind the riser merely functions first as an extra large vent and then as an unnecessary gadget which uses a lot of metal that otherwise might be poured into salable castings.

A recent experience illustrates how easily carelessness on the molder's part results in defective

(*Concluded on page* 94)

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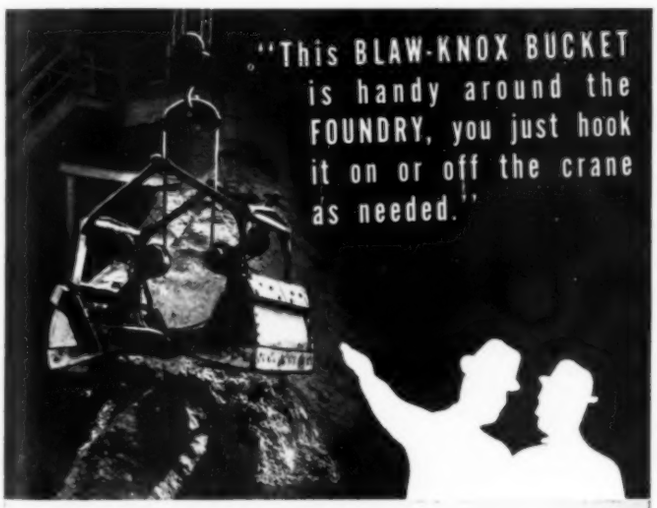


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castings. In machine molding moderately light castings the molder failed to distribute evenly the last shovelful of sand hastily thrown on top before applying the squeeze. This resulted in a variation of the density or hardness of the sand in the various molds and even in different parts of certain molds. The shakeout revealed a mixture of good and bad castings with a large number showing all the ear marks of missruns or cold shots.

Some molds produced all good castings, while other molds produced some good and some bad without any apparent reason for the inconsistency. The molder watched his pressure gage closely. His molding equipment was functioning in good shape, but the annoying missrun castings showed up at irregular intervals. Changing the pouring temperature of the metal, and adding an extra gate on each casting, did not improve the situation as the foreman confidently expected. When the cause was pointed out to him, the remedy was obvious and the trouble disappeared.

**Maintain Oven Temperature**

In discussing the subject of cores and coremaking the importance of the core oven should be stressed. Uniform distribution of heat throughout the oven is required to eliminate hot and cold areas. Definite core oven heat control is necessary at all times to insure proper dehydration first and then oxidation of the oil in the cores. Without this progressive action in drying or baking the cores the proper degree of strength and hardness, otherwise easily obtainable, may be totally lacking in the finished cores.

Oven temperature 25 degrees in excess of the recommended 400 to 425 degrees Fahr. drives off the moisture and some of the oil simultaneously and leaves little or no oil to oxidize and produce the hardness required to hold the core firmly and prevent rapid disintegration when in contact with the molten metal. In extreme cases of overheating the core will crumble as readily as a lump of ordinary bank sand when pressed lightly between the fingers and thumb. In such cases metal cuts into and mixes with the core sand and plays havoc with the machine tools.

In one instance a foundryman was firmly convinced that the metal, a 10 per cent tin and 10 per cent lead alloy with less than 0.02 per cent phosphorus, was responsible for cutting into the cores. Everything else in connection with his particular operation was satisfactory—but investigation showed the crumbly cores were responsible. The so-called core oven consisted of the bottom section of a second hand ordinary kitchen gas stove, but lacking the regular heat controlling device. In this foundry the practice was to light the gas and open the burner to the limit to get the cores out in the shortest possible time.

Many foundrymen wonder why a tried and proven molding sand which functions satisfactorily with red brass and bronze castings should cause trouble in running the same or similar castings in yellow brass, semired and manganese bronze mixtures. The answer is simple—the higher zinc mixtures produce far more white flake oxide whenever the molten metal comes into contact with the atmosphere; and they also develop a great deal more fumes and gas inside the molds.

Obviously the molds for casting the higher zinc mixtures necessarily must be more open or permeable to provide adequate passage for the free and easy escape of fumes and gas through the sand. Failure to recognize this important factor causes endless trouble by setting up a back pressure resulting in missrun castings which have all the ear marks of having been run at too low a temperature—"cold metal." Foundrymen frequently adopt this erroneous diagnosis after examining the defective castings.

**Pour Metal Carefully**

It is quite important to see that so far as possible no secondary air is drawn into the mold through the sprue when pouring semired; yellow brass or manganese bronze mixtures containing a fairly high percentage of zinc. Preferably the sprue should be located near the outer edge of the mold instead of in the center. Near the edge the pourer can keep the lip of the ladle or crucible close to the sprue opening. This minimizes the secondary air hazard and insures a steadier and more uniform flow of metal from crucible to mold.

Where the sprue opening is in the center of the mold the pourer has to jockey the crucible around into pouring position high above the sprue opening. This practice not only causes unnecessary spillage, plus excess dross or oxide through drawing in of secondary air, but it also sets up a lot of turbulence and agitation with resulting cutting of the sand, a sure way to produce defective nonferrous castings.

Excepting under certain conditions, seldom practical in nonferrous foundry operation, it is impossible to prevent molten metal from combining with atmospheric oxygen to form oxide particles even within the mold cavities. The peculiarly annoying feature in connection with these oxide particles is that they do not show up until the castings have been machined, polished or plated and labor, production and overhead costs have been lost beyond recall.

Numerous other features contribute to or are responsible for defects in nonferrous alloy castings. Volumes could be written upon the subject without covering every contingency.

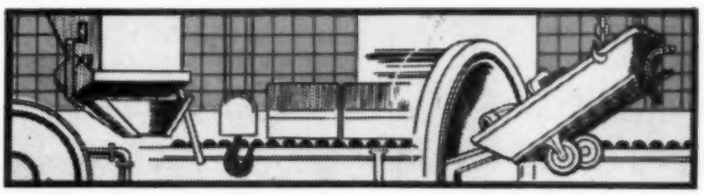
## A.F.A. Recommends Safety Practices

American Foundrymen's association recently has published, *Recommended Good Safety Practices for the Protection of Workers in Foundries* as developed by the Industrial Hygiene Codes committee of that organization. This latest edition to the codes of that committee undoubtedly is the most complete report ever prepared for providing safe practices in the foundry industry.

The report covers every phase of foundry practice as may be indicated by the following sectional headings: Safety practices; plant layout; melting, oven, furnace and auxiliary equipment in operation; material handling and storage; cleaning and finishing; safeguards in connection with moving machinery; guarding of prime movers and auxiliary parts; guarding of power transmission equipment; safeguarding metal working machines in operation; safeguarding woodworking machines in operation; guarding miscellaneous machinery and equipment; vats, pans, boilers, tanks and pressure devices; personal protective devices; inspection and maintenance; ladders; compressor or gas mixing unit; heating; electrical equipment; illumination; and first aid. The information contained in this report should be of immense value to plant managers, superintendents, foremen, as well as the safety engineer. The publication may be obtained through the association, 222 West Adams street, Chicago, for $1.25.

This is the fifth in a series of reports by the Industrial Hygiene Codes committee on subjects vital to safety and health in the foundry. Other reports available through the association and the cost of each are as follows: *Tentative Code of Recommended Practices for Testing and Measuring Air Flow in Exhaust Systems*, 50 cents; *Tentative Code of Recommended Practices for Grinding, Polishing and Buffing Equipment Sanitation*, 50 cents; *Tentative Recommended Good Practice Code and Handbook on Fundamentals of Design, Construction, Operation and Maintenance of Exhaust Systems*, $2.00; and *Code of Recommended Good Practices for Metal Cleaning Sanitation*, $1.25.

# NEW EQUIPMENT . . .



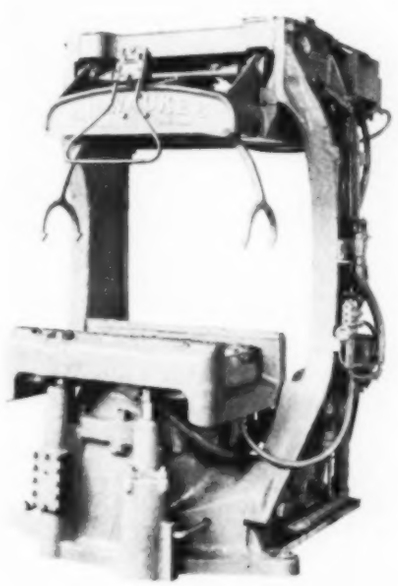
## AND SUPPLIES

### Molding Machine

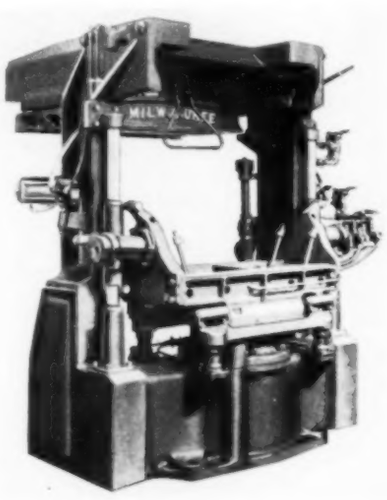
Milwaukee Foundry Equipment Co., 3228 West Pierce street, Milwaukee, has added two new machines to its line of molding equipment. Announced for the first time at the Foundry and Allied Industries show, in Chicago, the machines were displayed as companion units for making both copes and drags, wherever intensive production schedules are required.

One of these units, a jolt squeeze rollover pattern draw machine, is claimed to represent a complete departure from the conventional in this type of molder. The machine is described as having almost the same simple operating sequence as the jolt squeeze stripping type with the jolting and squeezing action taking place in the same natural fashion. Squeeze is against fixed peens, requiring no bottom boards, or loose peen boards and only one complete stroke of the squeeze piston is necessary for the entire molding cycle. Rollover mechanism is air operated making its action independent of exact balancing of flask and pattern loads. Pattern is withdrawn upward from the mold leaving it in an upright position on conveyor sections attached to the unit thus contributing to fast removal.

Companion unit, a jolt squeeze stripping machine, is of the more conventional type normally used for making copes. Features claimed include the method of suspending the squeezing head and the manner in which it automatically removes the completed mold and deposits it on a conveyor. Squeeze platen is mounted on an overhead car capable of being pulled easily into position over the flask. After the squeeze pressure has been applied and the pattern has been drawn by normal stripping action, the mold

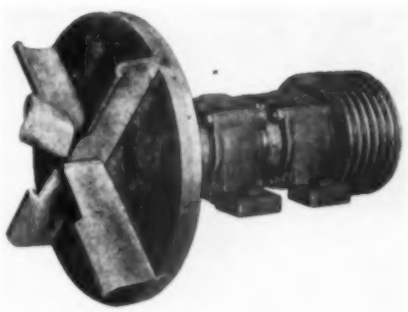


is lifted automatically from the stripping frame by two specially designed hooks suspended from the squeeze head car. Electric switches control the action of the lifting cylinder activating the lift hooks and operate automatically to set mold on a nearby section of conveyor when the squeeze car is pushed into the back position.



### Blast Cleaning

Two new pieces of equipment, a blast rotary mill and blast rotary table were shown for the first time by the W. W. Sly Mfg. Co., Cleveland, at the recent foundry exhibition in Chicago. Many advantages are claimed by the maker for these



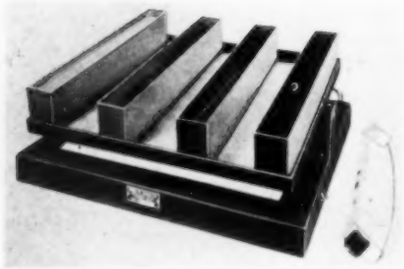
new units in more effective blasting and lower operating costs. The features center chiefly in the blasting wheel.

Abrasive is fed to the wheel in a simple manner with an initial velocity produced by a small blower. This distributes it uniformly over the blades of the blast wheel. This, plus the centrifugal velocity created by the wheel results in a powerful blast concentrated and directionally controlled. The abrasive feed arrangements are said to eliminate wearing parts at this point, and crushing and grinding.

Among the features of these machines are special alloy wear plates on rotor, housing liners and other parts, cast sectionally for quick and easy replacement. These blades are so designed and fastened in the wheel so that they can be changed readily by loosening two screws. The blast mill is for cleaning rugged castings; the rotary table is for the more delicate, flat and intricate castings.

### Developing Unit

Harry W. Dietert Co., 9330 Roselawn avenue, Detroit, recently has placed on the market a plate or film developing unit, shown in the accompanying illustration, in which the pivoted top table is rocked by a motor driven cam. Developing, stop, hardening and fixing solutions automatically are controlled at a temperature of 70 degrees Fahr. by water circulating through a copper coil attached to the bottom of the rocking table. Circulating water is taken from the city water supply line and



passed through a chamber containing an electric heater and a 70 degree Fahr., thermostat. It is claimed a plate or film may be processed within 2 minutes uniformly without grain growth. The unit is particularly applicable in spectrographic and metallographic laboratories.

## Cleaning Unit

American Foundry Equipment Co., Mishawaka, Ind., has introduced a new combination casting cleaning unit, especially designed for the jobbing foundry and which includes a tumbling unit on one side and a table unit on the opposite side as shown in the accompanying illustrations. Conveyor for the tumbling unit is available with either endless rubber belt or steel flights. Castings are carried through the other or cabinet unit on a single steel plate table covered with heavy perforated rubber.

In both units abrasive from an overhead storage hopper is fed by gravity through a chute and control cage to the center of a special type wheel revolving at high speed. By centrifugal force the abrasive is thrown from the wheel in a steady stream against the castings. A cast alloy impeller rotates with the wheel and carries abrasive to an opening in the stationary control cage where it discharges to the bladed section of the wheel. The abrasive picked up by the inner ends of the blades gradually is accelerated in its passage to the periphery. Final throwing velocity results from radial and tangential forces. It is claimed any type of finish can be obtained on the castings by the proper selection of abrasive material.

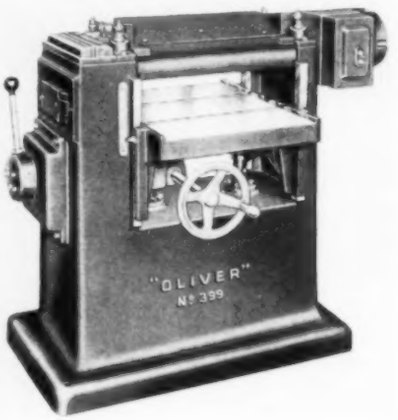
## Safety Goggles

American Optical Co., Southbridge, Mass., is supplying its safety goggles with a new type bridge or nose piece, in a new range of three eye and three bridge sizes. The new double braced bridge soldered at four places to the lens frame instead of the conventional two permitted by the ordinary bridge is an exceptionally sturdy design that assures long service under hard use. Added rigidity resulting from the longer bearing surface of the bridge on the lens frame means that the goggles will stay in proper adjustment longer under the most strenuous daily handling and even under impact. Modern styling and decorative milling of the bridge improve the entire appearance of the goggles. To secure more accurate fittings to individual workers they will be supplied in three eye sizes, 44, 47 and 50 millimeters, and three bridge sizes, 21, 23 and 25 millimeters between lenses.

## Wood Planer

Oliver Machinery Co., Grand Rapids, Mich., has introduced a new single surface planer, as shown in the accompanying illustration, in which the base sides and housings for the cylinder and the upper roll bearings are cast in one piece, assuring perfect, permanent alignment. Other claims include rigid table support in which unusually deep square gibbed ways keep the table parallel; antifriction bearings; all operating adjustments made from the top; feed control lever easily shifted; enclosing covers for all running parts and fender over cutter head provide maximum safety.

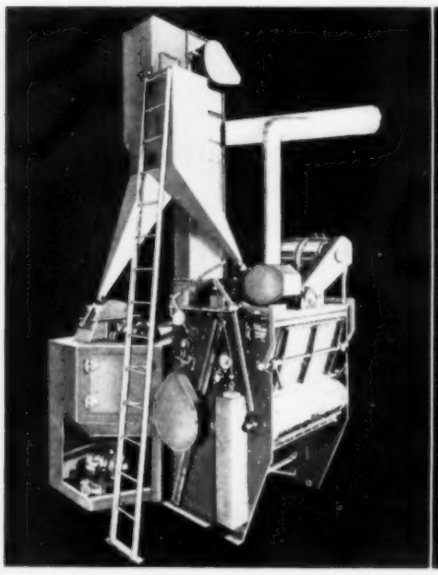
The machine has capacity for pieces 6 inches thick and 18 inches wide. It is driven by a 3 horsepower motor running at 3600 revolutions per minute, direct mounted, enclosed and fan cooled, push button control and over load protection. Table has lower rolls running on frictionless roller bearings, wide vertical bearings with gibs for take-

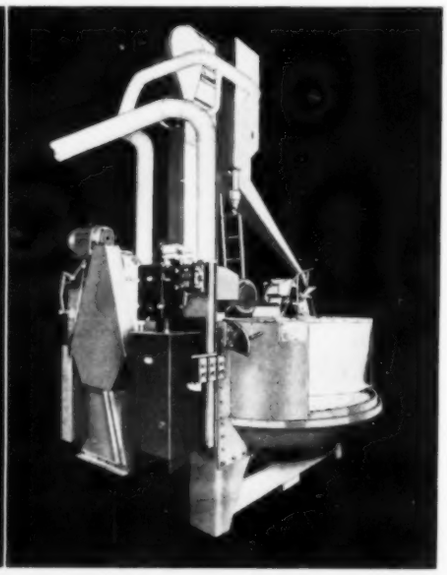



up of wear. It is supported on two large screws which have adjustable nuts to maintain perfect alignment with the cylinder. Working surface 18 x 24 inches. A motor driven knife grinder unit can be supplied as an extra, self contained with V-belt drive to emery wheel. The cylinder is arranged for indexing perfectly.

## Insulating Brick

Babcock & Wilcox Co., 85 Liberty street, New York, has introduced a new insulating firebrick which, it is claimed, has the stability of a fired clay refractory, weighs less and the insulating values are comparable with or superior to unfired insulating materials. Made of special Georgia kaolin, the manufacturer states these brick retain their structure, show negligible shrinkage, and can withstand loading without deformation at temperatures up to 1600 degrees Fahr. for direct exposure and 2000 degrees Fahr. (interface) for backing up. Average weight is 1.1 pounds for 9-inch straight or approximately 19 pounds per cubic foot. In a typical 9-inch wall of dense firebrick backed by a 4½-inch wall of the new material, the heat flow loss is reduced by 76 per cent.





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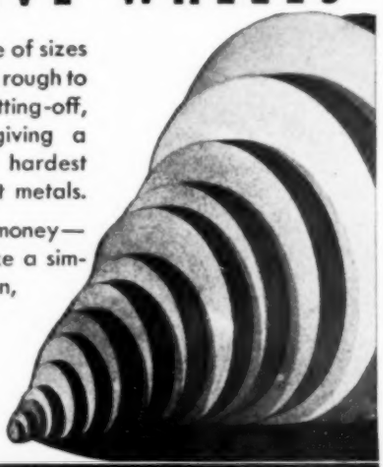
## ABRASIVE WHEELS

MADE in a full range of sizes and grained from rough to flour for snagging cutting-off, rough-grinding or giving a mirror finish on the hardest nitrided alloys or soft metals.

If you want to save money—even on what looks like a simple grinding operation, consult our

***ABRASIVE WHEEL DEPARTMENT***



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OF RAYBESTOS-MANHATTAN, INC.
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Prepare molding and core sands to predetermined moisture, permeability and strength and save castings.

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Accurate temperature determination of molten iron and nonferrous metals in ladles by immersion pyrometer. Range from room temperature to 3100° F. Economical in cost and in use. Time required for reading is 50 seconds.

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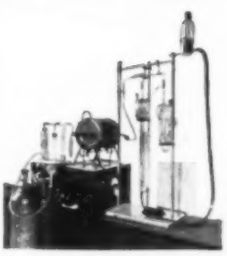

*Carbon Determinator*

Use cast specimens for carbon and sulphur determinations and save time. This is made practical with our specimen mold.

Accurate carbon determinations made in two minutes with the Carbon Determinator.

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SAND TESTING — FERROTEMP — SPECTROGRAPH
QUICK CARBON DETERMINATOR — QUICK SULPHUR DETERMINATOR

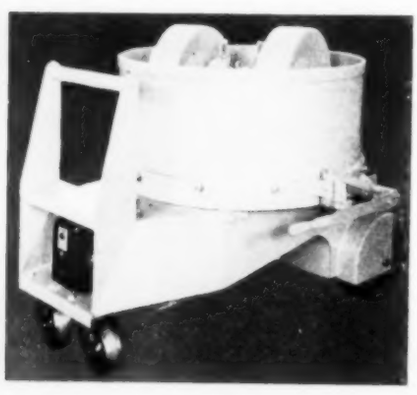
**HARRY W. DIETERT CO.**
9330A Roselawn Ave.
DETROIT, MICH.

## Sand Sifter

Great Western Mfg. Co., Leavenworth, Kans., has developed a screening and scientific testing device shown in the accompanying illustration for which accurate results are assured. It will determine the actual extraction and percentage of each separation made on different samples. Eight-inch diameter brass testing sieves are used. A maximum of sixteen 8-inch diameter receptacles or a minimum of one can be operated at one time and each sieve produces accurate results. The device operates without jar or shock and is driven by a special 1/6-horsepower totally enclosed motor running at 900 revolutions per minute. It can be hooked on to any standard light or power socket. Special removable tapping device can be attached for use when particularly difficult or sticky samples are being tested. Special time switch can be furnished for use in connection with the machine to eliminate any possible errors in timing.

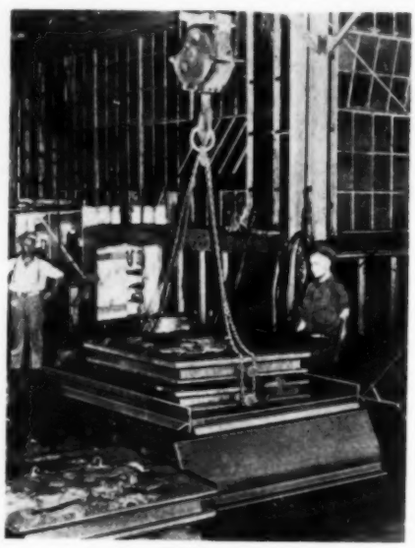
## Sand Mixer

National Engineering Co., 549 West Washington blvd., Chicago, has developed a new portable type intensive sand mixer containing all the essential features of the larger machines. This particular unit shown in the accompanying illustration was in use in the Crane Technical high school operating exhibit at the recent A.F.A. convention in Chicago, May 4 to May 10. The machine has a capacity of approximately 200 pounds of sand per batch for which the mixing time ordinarily is from 2 to 4 minutes depending on the class of sand. The self contained motor driven unit is mounted on wheels and may be pushed to any desired location on the floor, or moved from one place to another by the crane. This type machine also is available with a 4-foot diameter pan and a capacity of 400 pounds of sand per batch. Either machine is driven by a 5-horsepower motor and it is claimed the new portable feature of the sand mixers will appeal to the smaller foundries.



## Shakeout Screen

Robins Conveying Belt Co., 15 Park Row, New York, announces a new shakeout and screening device shown in the accompanying illustration. The unit is available in sizes for handling small flasks, medium size flasks, or large flasks weighing up to 4 tons. It is claimed the motion of the screening surface is sharp and rapid to loosen all the sand in a few seconds. The entire unit is designed to withstand heavy loads or shocks. Hot sand cannot get near any moving part of the vibrating mechanism or the bearings on the screen. The top surface is flat and low, only 2 feet above the floor and thus very convenient and accessible. Sizes of the shakeout and screening device range from 4 x 10½ feet to 5 x 14 feet.



The 1940 National Metal congress and exposition will be held in the public auditorium, Cleveland, the week of Oct. 21. W. H. Eisenman, Cleveland, is manager.

## Tablet Dispenser

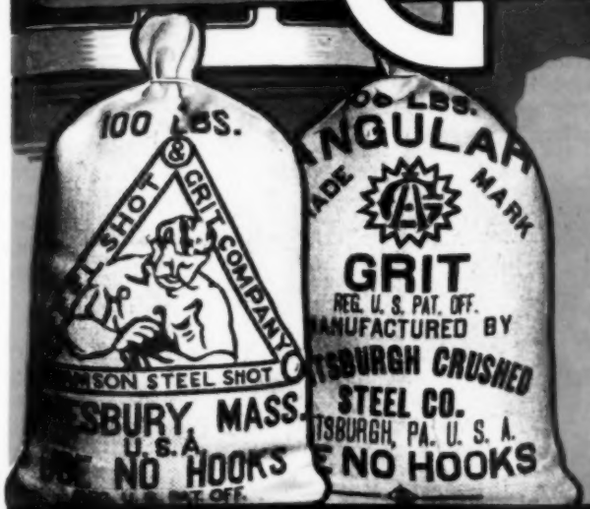
Milburn Co., 905 Henry street, Detroit, has placed on the market a salt tablet dispenser, shown in the accompanying illustration, and designed for use in industrial plants. The container holds one thousand 10 or 15 grain tablets. A simple flip of the finger trigger discharges one tablet at a time into the workman's hand. Moisture and corrosion proof, the unit is impervious to the salt content. It is constructed strongly and simply and has a lock which safe guards the contents and locks unit to the wall bracket or any other convenient fastening place in the vicinity of the drinking fountain.

## Dowel Pins

Federal Foundry Supply Co., 4625 East Seventy-first street, Cleveland, announces a triangular shape dowel pin for patterns, designed to prevent wabbling and to eliminate the need for an extension bit for installation. All the boring may be done with an ordinary bit same diameter as the pin. Male and female halves are the same size, interchangeable in any position and it is claimed always give a smooth, tight fit without binding. Shape of the fitting eliminates possibility of twisting.

Malleable knock down lugs tapped over the screw heads prevent the screws from working loose, even it is claimed when the patterns are used constantly on a bumping machine.

# GREAT GUNS




are made of the same tough steel that is used in making "CERTIFIED" Steel Abrasives. That is why this old established blast cleaning abrasive is so economical to use. Its tough sharpness cannot easily be destroyed . . . it has the strength and stamina to stand up under all the exacting requirements of airless and air blast cleaning methods.

There are sizes of both Grit and Shot for every need. *Write for contract data.*

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*For 30 Years*

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Foundry Supplies and Equipment

**E. J. WOODISON COMPANY**
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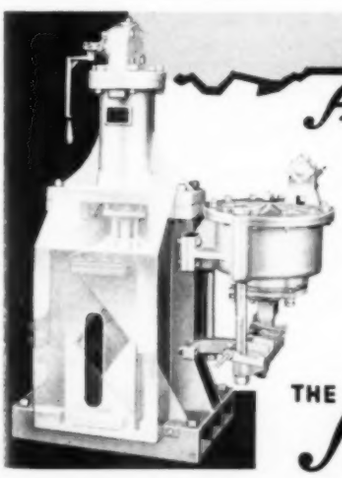
## STRAIGHTEN OUT *your* SCRAP LOSSES *with an* *American* ROD STRAIGHTENER *and* SHEAR MACHINE



No longer is it necessary to scrap core rods or reclaim them laboriously by hand when an American Rod Straightener will form gaggers, reduce the purchase of stock, and eliminate costly hand straightening. In hundreds of plants the machine has paid for itself in from 3 to 6 months. Four popular priced sizes are available for straightening rods from $\frac{5}{8}$" to $1\frac{1}{4}$" diameter, and for shearing rods from $\frac{3}{8}$" to $\frac{3}{4}$" diameter. Material is handled as fast as it can be fed into the machine—no skilled labor is required. Oiling is the only attention the machine requires for constant, efficient use.

WRITE for FREE BULLETIN No. 10

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OFFICES IN ALL PRINCIPAL CITIES

# Obituary

GEN. OTTO H. FALK, 74, chairman of the board, Allis-Chalmers Mfg. Co., Milwaukee, died May 21 at his home in that city. General Falk was born in Milwaukee June 18, 1865. After attending the German-American academy and Northwestern college he enrolled in the Allen Military academy, Chicago, and was graduated as a captain. He was active in the National Guard and had achieved the rank of brigadier general when he retired in 1911. He was made receiver of the Allis-Chalmers Co., in 1912 and about a year later was elected president. In addition to a great number of commercial, manufacturing, banking, civic, social and philanthropic organizations the general was a member of the United States Infantry association, Military Service institute National Guard association of Wisconsin, Wisconsin State Rifle association, Military Order of Foreign Wars and the Spanish American War Veteran's association. On two occasions he was selected as Milwaukee's most distinguished citizen.

* * *

N. A. Strand, a partner in the N. A. Strand & Co., Chicago, died recently at his home in Evanston, Ill.

* * *

Michael Oesterle, 78, pattern clerk and foreman for more than 30 years, Johnston & Jennings Co., Cleveland, died May 30 in that city.

* * *

William H. Quinn, New York district manager, Chain Belt Co., Milwaukee, died May 5 in New York. Mr. Quinn has been with the company since 1923 and manager of the New York office since 1928.

* * *

Edgar L. Mitchell, member of the Beardsley & Piper Co., Chicago, died April 2. Mr. Mitchell was born in Newton, Pa., but lived many years in Baltimore. He was the first salesman for the Beardsley & Piper organization.

* * *

John J. Crozier, 64, president, Kennett Foundry & Machine Co., Kennett Square, Pa., and vice president, International Reclaiming Corp., New York, died May 29 at his home. Mr. Crozier was a son of J. Eli Crozier, founder of the Kennett company.

* * *

Josiah McCartney, 86, founder of the Great Lakes Brass Foundry, Bay City, Mich., died recently at his home in that city. Mr. McCartney started the foundry about 1900 and had operated it since that time, in recent years with the assistance of his son, Hugh McCartney.

* * *

Harvey C. Wilson, secretary, Cleveland Co-Operative Stove Co., Cleveland, died May 27 at his home. Mr. Wilson was born in Washington Court House, O., and was a graduate of Ohio Wesleyan college, Delaware, O. After graduation, he taught school for a brief period, leaving teaching to enter thte service of the bank at Washington Court House. Mr. Wilson left the bank to become connected with the Wonder Stove

Gen. Otto H. Falk

Co. in the same city. He advanced to the position of general manager of that company and held that position until 1911, when he resigned to become general sales manager of the Cleveland Co-Operative Stove Co. In March, 1919 Mr. Wilson was elected secretary of the Cleveland company

* * *

Samuel F. McClure, 70, representative of Ajax Metal Co. in the Pennsylvania region for more than 40 years, died May 15 at Philadelphia. Previous to his Ajax affiliation, Mr. McClure was with the Hood Smelting Co.

* * *

August C. Thode, 62, assistant patternshop superintendent Allis-Chalmers Mfg. Co., West Allis, Wis., died May 14. Born in Muskego, Wis., he had lived the greater part of his life in Milwaukee and Wauwatosa and had been connected with the Allis-Chalmers organization for the past 39 years.

* * *

John Wesley Collins Sr., plant manager, Aluminum Co. of America, Detroit, died June 1 at the Henry Ford hospital, following a brief illness. Mr. Collins was born in Strathroy, Ont., Oct. 24, 1885, and had lived in Detroit for the past 35 years. Mr. Collins was a member of the American Foundrymen's association and served as a member of the Detroit committee at the time of the annual convention in 1936.

* * *

John H. Cavender, 55, vice president and director, North American Refractories Co., Cleveland, died May 29 at his home in Cleveland Heights, O. Mr. Cavender had been vice president of the company since its formation in 1929 and prior to that was president of the Dover Fire Brick Co., one of the companies merged to form North American. Before going to Cleveland he was with the Chicago Retort & Fire Brick Co. He was the first treasurer and a former president, Refractories Manufacturers association, now known as the American Refractories institute.

* * *

John E. Riffer, executive manager, St. Catherines Brass Works, St. Catherines, Ont., died May 31. Mr. Riffer was born in Elmira, Ont., March 20, 1880, and received his early education there. He then served apprenticeship as a molder and studied mechanical engineering through a night course. As a young man he went to the United States and gained practical experience in brass foundries during a 9-year period, working his way up to the position of foreman and then plant superintendent. In 1909 he went to St. Catherines and started a business, and in 1916 he built the present St. Catherines Brass Works Ltd. Mr. Riffer took an active part in civic affairs, and from 1919 to 1923 served as alderman on the city council. Since 1922 he was chairman of the Lincoln suburban roads commission, and recently he was a member of the advisory vocational committee of the board of education.

* * *

Russell M. Scott, 55, for nearly 20 years superintendent of the foundry, Packard Motor Car Co., Detroit, and more recently associated with the foundries of the Pontiac division, General Motors Corp., and the McKinnon Industries, St. Catherines, Ont., died in Detroit, May 30. Mr. Scott was born in Walkerville, Ont., and was educated in the public schools. He served his apprenticeship as patternmaker at the Cleveland Punch & Shear Works. After 2 years spent in various shops, he became connected with the Packard Motor Car Co. in 1907, and until 1912 worked at the bench as a patternmaker. In 1913 he was made general foreman and in 1920 assistant foundry superintendent and later foundry superintendent. In July, 1925 he was appointed foundry manager. He became associated with the Pontiac Motor division in 1937.

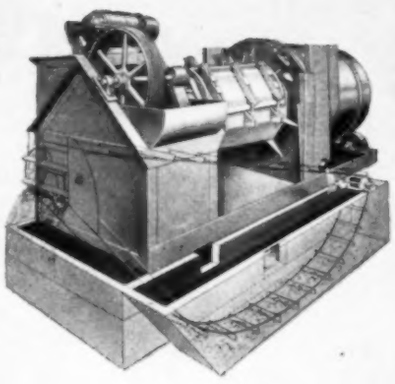
# MULLER

CLEARFIELD
MACHINE COMPANY

CLEARFIELD
PENNSYLVANIA, U. S. A.

# MIXERS





## CLEAN CASTINGS in 2⅔ HOURS A DAY

If your casting cleaning room has to run all day to keep up with production, a Ransohoff Machine can do the job in 2 2 3 hours, because it cleans three times as fast as old fashioned methods.

The wet tumbling, excess star method, coupled with automatic star separation and return, automatic end unloading, will do the job better in one third of the time. There are end loading machines for small castings and side loading machines for castings up to 24 inches, and there are automatic sand removers for the settling tank.

Look into this time and labor saver that is dustless, dependable and low in cost.

**N. RANSOHOFF, INC., 208 W. 71st St., Cincinnati, Ohio**

# GOOSE LAKE

Illinois Clay Products Company

*Fire Clay and*
*Fire Clay Flour*
*Fire Clay Brick*
*Therm-O-Flake Insulation*

JOLIET, ILL.

# Foundry Activities

DOW CHEMICAL CO. will build a foundry 200 x 80 feet at Bay City, Mich., for production of magnesium castings for aircraft. Structure will cost $100,000 and will employ more than 200 men.

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McCallum-Hatch Bronze Co., Inc., recently has moved to new offices and plant at 46 Letchworth street, corner Grant street, Buffalo.

* * *

Plant of the former American Malleable Co., Owosso, Mich., recently was sold to the Midwest Abrasive Co., Detroit, for $10,000.

* * *

Interstate Brass & Aluminum Co., Cleveland, newly organized, has leased a 1-story factory building at 3319 St. Clair avenue for use as a foundry.

* * *

Cameron Stove Mfg. Co., Richmond, Va., J. S. Gregg, president, has been incorporated to manufacture stoves, castings and other products, with $100,000 maximum capital.

* * *

Hanford Foundry Co. which has been operating at San Bernardino, Calif., recently was incorporated with a capital of $150,000. Directors are R. P. Drummond, William Guthrie and Carl B. Hilliard.

* * *

Kaukauna Machine Corp., Kaukauna, Wis., recently has been licensed by Sorbo-Mat Process Engineers, St. Louis, to use the process of that organization. Kaukauna company produces machine tool castings and machine tools.

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Bullard Co., Bridgeport, Conn., recently awarded the contract for a large addition to its foundry to the Turner Construction Co., New York. The foundry will be 1-story and basement measuring 360 x 90 feet and ready for occupation by Sept. 1.

* * *

American Magnesium Corp., Cleveland, a subsidiary of the Aluminum Co. of America, will open a plant of the Aluminum Co. of America at Buffalo, which has been idle for 8 years, to manufacture magnesium castings for the aircraft industry.

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Officers of the Galva Foundry Co., recently organized at Galva, Ill., are as follows: Fred C. Heiden, president, E. L. Heartlein, vice president, L. A. Hagney, secretary. Through an error it was mentioned in the June issue of THE FOUNDRY that Thomas Spencer of Fairfield, Iowa, was a partner in the organization.

* * *

Baldwin Locomotive Works, Philadelphia, has arranged for the transfer to itself of all assets, business and good will of the Standard Steel Works Co., Philadelphia, and has assumed all of that company's outstanding obligations. The Baldwin Locomotive Works is carrying on through its Standard Steel Works division all activities and business formerly carried on by the Standard Steel Works Co., without change in location, policy or personnel. It is contemplated that the Standard Steel Works Co. will be dissolved in the near future. Charles D. Brinley is president.

**RAW MATERIAL PRICES**
**June 18, 1940**

| | |
|---|---|
| **Iron** | |
| No. 2 foundry, Valley | $23.00 |
| No. 2 Southern Birmingham | 19.00 |
| No. 2 foundry, Chicago | 23.00 |
| No. 2 foundry, Buffalo | 23.00 |
| Basic, Buffalo | 22.00 |
| Basic, Valley | 22.50 |
| Malleable, Chicago | 23.00 |
| Malleable, Buffalo | 23.50 |
| Charcoal iron, furnace | 27.00 |
| **Coke** | |
| Connellsville beehive premium | $5.75 to $6.30 |
| Wise county beehive coke | 5.00 to 5.25 |
| Detroit by-product delivered | 11.00 |
| **Scrap** | |
| Heavy melting steel, Valley, No. 2 | $19.75 to $20.25 |
| Heavy melting steel, Pittsburgh, No. 2 | 18.50 to 19.00 |
| Heavy melting steel, Chicago, Auto No. 2 | 16.50 to 17.00 |
| Stove plate, Buffalo | 14.50 to 15.00 |
| Stove plate, Chicago | 11.50 to 12.00 |
| No. 1 cast, mchy., New York | 17.50 to 18.00 |
| No. 1 cast, mchy., Chicago | 16.50 to 17.00 |
| No. 1 cast, Pittsburgh | 20.00 to 20.50 |
| No. 1 cast, Philadelphia | 21.00 to 21.50 |
| No. 1 cast, Birmingham | 15.50 |
| Car wheels, iron, Pittsburgh | 20.00 to 20.50 |
| Car wheels, iron, Chicago | 18.50 to 19.00 |
| Railroad malleable, Chicago | 21.50 to 22.00 |
| Malleable, Buffalo | 20.00 to 20.50 |
| **Nonferrous Metals** | **Cents per pound** |
| Castings copper, refinery | 11.30 |
| Straits tin | 56.25 |
| Aluminum, 99 per cent | 19.00 |
| Aluminum, No. 12 (Secondary, standard) | 14.25 to 14.75 |
| Lead, New York | 5.00 |
| Antimony, New York | 14.00 |
| Nickel, electro | 35.00 |
| Zinc, East St. Louis, Ill. | 6.25 |

## Issues Proceedings

Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, England, has published its 1938-39 Proceedings which contains the report of the International Foundry congress and thirty-sixth annual conference of the institute held in London from June 12 to 17, 1939, and also papers and discussions presented at branch meetings held during the 1938-39 session. The book contains 520 pages, and appears for the first time in a new format size, 7¼ x 9¾ inches which is a great improvement over the previous much smaller size. It contains 44 papers with discussions.

## Adventures of Bill

(*Concluded from page* 59)

on at least one branch of the stockman problem."

"Well," said Bill, "if you will pardon me for coining a special and appropriate phrase for the occasion, many a true word often is spoken in jest. If it had not been for the United States navy, I never would have seen the masterpiece. I went over to the place where the plaque is hung to hear my old friend S. W. Brinson, master molder at the Norfolk navy yard present a highly practical paper on how steel castings are made to satisfy the exacting specifications of the toughest customer ever created, none other than your deep sea, brine soaked, gimlet eyed Uncle Samuel. To slightly paraphrase a one time commander in chief of the army and navy, 'You might fool some of the people all the time, and all the people some of the time, but you can't put anything over on the navy any of the time.' The paper prepared in collaboration with J. A. Duma, assistant metallurgist was illustrated with a number of slides showing large and intricate castings. Text of the address explained the theory and technique employed to produce perfect castings."

"The master stockman, hey, master of the art of arts! Where does that leave the master molder?"

"In the dog house," Bill complained bitterly. "Never appreciated at his true worth!"

The twenty-ninth annual safety congress and exposition held under the auspices of the National Safety Council, will be held at the Stevens hotel, Chicago, Oct. 7 to 11.